Problems for the 31st IYPT 2018

Released by the IOC on July 13th, 2017

The originator of a new concept finds, as a rule, that it is much more difficult to find out why other people do not understand him, than it was to discover the new truth.
Hermann von Helmholtz

1. Invent Yourself
Construct a simple seismograph that amplifies a local disturbance by mechanical, optical or electrical methods. Determine the typical response curve of your device and investigate the parameters of the damping constant. What is the maximum amplification that you can achieve?

2. Colour of Powders
If a coloured material is ground to a powder, in some cases the resulting powder may have a different colour to that of the original material. Investigate how the degree of grinding affects the apparent colour of the powder.

3. Dancing Coin
Take a strongly cooled bottle and put a coin on its neck. Over time you will hear a noise and see movements of the coin. Explain this phenomenon and investigate how the relevant parameters affect the dance.

4. Heron's Fountain
Construct a Heron's fountain and explain how it works. Investigate how the relevant parameters affect the height of the water jet.

5. Drinking Straw
When a drinking straw is placed in a glass of carbonated drink, it can rise up, sometimes toppling over the edge of the glass. Investigate and explain the motion of the straw and determine the conditions under which the straw will topple.

6. Ring Oiler
An oiled horizontal cylindrical shaft rotates around its axis at constant speed. Make a ring from a cardboard disc with the inner diameter roughly twice the diameter of the shaft and put the ring on the shaft. Depending on the tilt of the ring, it can travel along the shaft in either direction. Investigate the phenomenon.

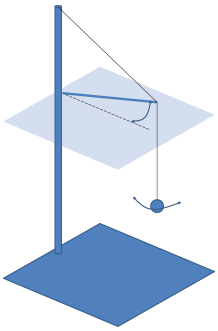
7. Conical Piles
Non-adhesive granular materials can be poured such that they form a cone-like pile. Investigate the parameters that affect the formation of the cone and the angle it makes with the ground.

8. Cusps in a Cylinder
A horizontal cylinder is partially filled with a viscous fluid. When the cylinder is rotated around its axis, unusual fluid behaviour can be observed, such as cusp-like shapes on the walls of the cylinder. Investigate the phenomenon.

9. Candle in Water
Add some weight to a candle such that it barely floats in water. As the candle burns, it may continue to float. Investigate and explain this phenomenon.

10. Tesla Valve
A Tesla valve is a fixed-geometry, passive, one-direction valve. A Tesla valve offers a resistance to flow that is much greater in one direction compared to the other. Create such a Tesla valve and investigate its relevant parameters.

11. Azimuthal-Radial Pendulum
Fix one end of a horizontal elastic rod to a rigid stand. Support the other end of the rod with a taut string to avoid vertical deflection and suspend a bob from it on another string (see figure). In the resulting pendulum the radial oscillations (parallel to the rod) can spontaneously convert into azimuthal oscillations (perpendicular to the rod) and vice versa. Investigate the phenomenon.



12. Curie Point Engine
Make a nickel disc that can rotate freely around its axis. Place a magnet near the edge of the disc and heat this side of it. The disc starts to rotate. Investigate the parameters affecting the rotation and optimize the design for a steady motion.

13. Weighing Time
It is commonly known that an hourglass changes its weight (as measured by a scale) while flowing. Investigate this phenomenon.

14. Radiant Lantern
When taking a picture of a glowing lantern at night, a number of rays emanating from the centre of the lantern may appear in the pictures. Explain and investigate this phenomenon.

15. Blowing Bubbles
When blowing on a soap film in a ring, a bubble may be formed. The liquid film may pop or continue to exist. Investigate how the number of bubbles produced from a single soap film and the characteristics of the bubbles depend on the relevant parameters.

16. Acoustic Levitation
Small objects can levitate in acoustic standing waves. Investigate the phenomenon. To what extent can you manipulate the objects?

17. Water Bottle
The current craze of water bottle flipping involves launching a partially filled plastic bottle into the air so that it performs a somersault before landing on a horizontal surface in a stable, upright position. Investigate the phenomenon and determine the parameters that will result in a successful flip.

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Figure by Andrei Klishin; **Problem selection committee:** John Balcombe, Samuel Byland, Ilya Martchenko; **Epigraph** selected by Evgeny Yunosov

IYPT 2018 Tentative Problem Set

1. Invent Yourself

Construct a simple seismograph that amplifies a local disturbance by mechanical, optical or electrical methods. Determine the typical response curve of your device and investigate the specific parameters of the damping constant. What is the maximum amplification that you can achieve?

2. Colour of Powders

If a coloured material is ground to a powder, in some cases the resulting powder may have a different colour to that of the original material. Investigate how the degree of grinding affects the apparent colour of the powder.

3. Dancing Coin

Take a strongly cooled bottle and put a coin on its neck. Over time you will hear a noise and see coin movements. Explain this phenomenon and investigate how the relevant parameters affect the dance.

4. Heron's Fountain

Construct a Heron’s fountain and explain how it works. Investigate how the relevant parameters affect the height of the water jet.

5. Drinking Straw

When a drinking straw is placed in a glass of carbonated drink, it can rise up, sometimes toppling over the edge of the glass. Investigate and explain the motion of the straw and determine the conditions under which the straw will topple.

6. Ring Oiler

An oiled horizontal cylindrical shaft rotates around its axis at constant speed. Make a ring from a cardboard disk with the inner diameter roughly twice the diameter of the shaft and put the ring on the shaft. Depending on the tilt of the ring, it can travel along the shaft in either direction. Investigate the phenomenon.

7. Conical Piles

Non-adhesive granular materials can be poured such that they form a cone-like pile. Investigate the parameters that affect the formation of the cone and the ultimate angle it makes with the ground.

8. Waves in a Cylinder

A horizontal cylinder is partially filled with a viscous fluid. When the cylinder is rotated around its axis, unusual fluid behaviour can be observed, such as sharp cusp-like waves on the walls of the cylinder. Investigate the phenomenon.

9. Candle in the Water

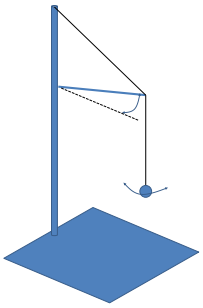
Add some weight to a candle such that it barely floats in water. As the candle burns, it may continue to float. Investigate and explain this phenomenon.

10. Tesla Valve

A Tesla valve is a fixed-geometry passive one-direction valve. A Tesla valve offers a resistance to flow that is much greater in one direction compared to the other. Create such a Tesla valve and investigate its relevant parameters.

11. Azimuthal-Radial Pendulum

Fix one end of a horizontal elastic rod to a rigid stand. Support the other end of the rod with a taut string to avoid vertical deflection and suspend a bob from it on another string (see Figure). In the resulting pendulum the radial oscillations (parallel to the rod) can spontaneously convert into azimuthal oscillations (perpendicular to the rod) and vice versa. Investigate the phenomenon.



12. Curie Point Engine

Make a nickel disc that can rotate freely around its axis. Place a magnet near the edge of the disk and heat this side of it. The disk starts to rotate. Investigate the parameters affecting the rotation and optimize the design for a steady motion.

13. Weighing Time

It is commonly known that an hourglass changes its weight (as measured by a scale) while flowing. Investigate this phenomenon.

14. Radiant Lantern

If you take a picture of a glowing lantern at night, a large number of rays emanating from the center of the lantern will turn out on the pictures. Explain and investigate this phenomenon.

15. Blowing Bubbles

When blowing on a liquid film in a ring, a bubble may be formed. The liquid film may pop or continue to exist as a thinner film. Investigate how the number of bubbles produced from a single film and the characteristics of the bubbles depend on the relevant parameters.

16. Acoustic Levitation

Small objects can levitate in acoustic standing waves. Investigate the phenomenon. To what extent can you manipulate the objects?

17. Water Bottle

The current craze of water bottle flipping involves launching a partially filled plastic bottle into the air so that it performs a somersault before landing on a horizontal surface in a stable, upright position. Investigate the phenomenon and determine the parameters that will result in a successful flip.

ID 2018-033

Curie Point Engine 4.00

Make a nickel disc that can rotate freely around its axis. Place a magnet near to the edge of the disk and heat this side of the disk. The disk starts to rotate. Investigate parameters affecting the rotation and optimize the design for a steady motion.

Figures:

Origins:

Can be seen on the Internet, e. g. https://www.youtube.com/watch?v=-cJ0VS3K34I

Novelty:

There was a similar IYPT problem in the past, but I endorse the new proposal as interesting and important

Comments:

The driving force is magnetic force. Heating the disk on one place results in the loss of feromagnetic properties of nickel. The resulting motion is affected by the magnet, the heat source and by cooling the disk. Finally is the problem complex enough for theoretical analysis and/or the experimental investigation.
In 1999 there was a similar problem "7. Heated needle" (pendulum). Proposed design is more symmetric and thus more promising for the analysis.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/06/24 SB: Is nickel a requirement or does it also work with iron?
2017/06/24 IM: For nickel, the Curie point is 627 K, but for iron it is 1043 K. Heating an object up to 350 C is much easier than up to 770 C.
2017/06/24 SB: Are nickel coins or discs easy to get?
2017/06/26 JB: I too was a little concerned about sourcing nickel but it is not impossible.

ID 2018-004

Acoustic Levitation 3.93

Small objects can levitate in acoustic standing wave. Investigate the phenomenon. To what extent can you manipulate the particle?

Figures:

Origins:

1. R. Cordaro and C. F. Cordaro. A demonstration of acoustical levitation The Physics Teacher 24, 416 (1986); doi: 10.1119/1.2342069
2. R. Scott Schappe and Cinthya Barbosa. A Simple, Inexpensive Acoustic Levitation Apparatus. Phys. Teach. 55, (2017); doi: 10.1119/1.4972488
3. E. H. Brandt. Suspended by sound. Nature 413, 474-475 (2001) doi:10.1038/35097192
4. https://youtu.be/0K8zs-KSitc
5. https://youtu.be/FaOqyJpT7AM

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Levitating particle can be liquid or solid. Configuration of standing wave (sound beam shape) can be of great importance. The dependence of particle shape on radiation force also can be investigated. The question "To what extent can you manipulate the particle?" implies whether it is possible to move or guide a particle with the help of standing acoustic wave.

Feasibility:

I trust literature or information from my colleagues that the problem is apparently feasible at the IYPT level

Discussion:

2017/06/24 SB: Task should be clarified.
2017/06/24 SB: 1 IOC member has doubts about feasibility. The article in reference 1 describes a simple setup that should allow to observe the effect.
2017/06/24 IM: I would suggest asking the question about the feasibility to the author. The videos and papers look great, but how easy is it to make a working apparatus?
2017/06/26 JB: This will perhaps be a challenging apparatus to set up but I don't believe that it is impossible. I have seen the videos of it being done with ultrasound but that uses apparatus not available in schools.
2017/06/29 Author: I also asked myself the same question. That is why I looked for article with demonstration. According to [1] and [2] we need at least one or two ultrasonic speakers (25-40 kHz) and oscillograph to make a standing wave. Ultrasonic piezo speakers can be quite cheap (for example http://www.ebay.com/bhp/ultrasonic-transducer-40khz). I think

that the cost is lower than the cost of metronomes for this year.
Unfortunately, I didn't managed to verify this effect by myself because of lack of time, but I guess that articles above can confirm the feasibility.

ID 2018-022

Candle in the Water 3.67

Add some weight to a candle such that it barely floats in water. When the candle burns, it will continue to float although the buoyancy force decreases faster than the weight. Investigate this phenomenon.

Figures:

Origins:

"The paradox of the floating candle that continues to burn", American Journal of Physics 80, 657 (2012)

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

A qualitative explanation of this phenomenon is easily available. Students are expected to develop a reasonable model for the shape of the "cavity" developing in the candle as a function of time, which involves challenging thermodynamical calculations.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/06/24 SB: Wording should be “(...) although the buoyancy apparently decreases faster than the weight.”
2017/06/24 IM: I agree. The candle turns into a hollow wax cylinder and its volume is not decreasing. This is relatively evident, and we should not add confusing statements into the task.
2017/06/26 JB: Why mention buoyancy force and weight at all? surely these are aspects of the phenomenon that need investigating!
2017/06/29 SB: Agree. This part of the second sentence can be deleted without making the problem less clear.

ID 2018-030a (2018-030)

Conical Piles 3.67

Non-adhesive granular materials can be poured such that they form a cone like pile. Investigate the parameters which affect the formation of the cone and the ultimate angle it makes with the ground.

Figures:

https://s3.amazonaws.com/aphs.worldnomads.com/sarahg/38315/IMG_9574.jpg

Origins:

Inspired by images of spices piled high at spice markets.

Novelty:

I am not sure whether a similar problem has been at the IYPT in the past

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: They are not exactly the same, but I would strongly consider merging ID 2018-030 "Conical Piles" and ID 2018-099 "Sandpile"
2017/04/26 JB I think the addition of avalanches to ‘Sandpile’ makes them sufficiently different but they are too similar to have both selected. They should go to the vote I think.

ID 2018-096

Reverse Shear 3.67

Fill the space between two transparent coaxial cylinders with a transparent viscous fluid and inject a few droplets of contrast dye into the fluid. As you slowly rotate one cylinder with respect to another by several full turns, the dye pattern smears. If you then rotate the cylinders back by the same number of turns, under certain conditions the dye droplets take exactly the same positions as in the beginning. Investigate the phenomenon.

Figures:

Origins:

This is a well-known phenomenon documented in many educational videos.
https://www.youtube.com/watch?v=p08_KlTKP50
https://www.youtube.com/watch?v=_dbnH-BBSNo
https://www.youtube.com/watch?v=IFR1ETk0Ssc
http://io9.gizmodo.com/your-guide-to-one-of-the-coolest-physics-demonstrations-1442968064
https://www.stevespanglerscience.com/lab/experiments/twist-in-time-laminar-flow/

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

The problem boils down to conditions under which laminar liquid flow is reversible. Because of high viscosity of the liquid, in this setup the flow is reversible even after the spectacular deformation of several full turns. Perhaps the effect can be achieved with plain water as well.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/06/24 IM: Is it easy to find such large transparent cylinders?
2017/06/26 JB: That could be quite difficult especially as the gap between them has to be controlled quite precisely.
2017/06/30 Author: I haven't had a chance to do the experiment myself (perils of being a theoretical physicist). However, you you look here:
https://www.youtube.com/results?q=reversible+flow, it is evident that many people independently reproduced the effect. In this video the inserted object in the middle is now even a cylinder, but the effect still works fine. Getting a highly viscous Newtonian fluid is easy - any high-sugar syrup will do. Getting a pair of cylinders should not be hard, the

material is not too specific, can use anything from plastic beakers to glass beer steins or coffee mugs as long as you can see through. Mounting them on the same axis is also easily doable. Also I intentionally did not say in the statement that the cylinder gap has to be small compared to cylinders radius. It would be the case easiest to explain and analyze, but not the only one where the effect works. In some videos there are cylinders with radii around 3 and 5 cm and the effect works just fine. Of course if the ratio of radii gets larger than 2, effect might break due to geometric nonlinearities, but until then it sohuld work fine. Getting a really low Reynolds number is easy here.

ID 2018-011

Azimuthal-Radial Pendulum 3.60

Fix one end of a horizontal elastic rod to a solid stand. Support the other end of the rod with a taut string to avoid vertical buckling and suspend a bob from it on another string (see Figure). In the resulting pendulum the radial oscillations (along the rod) can spontaneously convert into azimuthal oscillations (perpendicular to the rod) and vice versa. Investigate the phenomenon.

Figures:

Figure in the problem text refers to the following picture by the problem author:
https://drive.google.com/file/d/0B7bQI-pIv9ZeODJIRF9QRmxvazg/view?usp=sharing

Origins:

Original model suggested by B. Ya. Zeldovich of University of Central Florida:
https://www.osapublishing.org/abstract.cfm?uri=ope-2006-JWD49
The setup was built and shot in a demonstration video by University of Michigan Demo Lab:
https://drive.google.com/file/d/0B7bQI-pIv9ZeY0taRU9RNmUxU00/view

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

This is a simple mechanical system that is very easy to build. The nonlinear coupling of two harmonics doesn't induce chaotic behavior but rather makes the oscillation energy flow back and forth between the harmonics. The mathematics are similar to a number of optical phenomena, in particular when one considers interactions of both electic and magnetic parts of an EM wave with a free charge.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-019b (2018-131)

Water Bottle 3.60

The current craze of water bottle flipping involves launching a partially filled plastic bottle into the air so that it performs a somersault before landing on a horizontal surface in a stable, upright position. Investigate the phenomenon and determine the parameters that will result in a successful flip.

Figures:

Origins:

This is currently a very popular 'trick' amongst young students.

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

A simple enough idea but some interesting physics.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 SB: Merged with ID 2018-019
2017/06/26 JB: This will be very popular with the students!

ID 2018-035b (2018-054)

Frosty Phone 3.60

When a piece of metal is placed on dry or very cold ice, it starts ringing (see https://www.youtube.com/watch?v=vBGmQrGKqf4). Investigate the origin of this sound and the relevant parameters driving this phenomenon.

Figures:

Origins:

Noticed this while performing biology experiments with dry ice

Novelty:

I am not sure whether a similar problem has been at the IYPT in the past

Comments:

Fascinating and NEW phenomenon, easy to reproduce, can be addressed at various levels from a basic understanding to a more complex prediction of sound pitch as a function of various parameters (mass, temperature, material type and shape, etc.).

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: ID 2018-035 "Dancing Coin", ID 2018-054 "Frosty Phone" and ID 2018-127 "Trevelyan's Rocker" can be about the same effect and, if so, should be merged. The geometry of the vibrating objects is not the same, and the sounds in youtube videos are not similar. But in each case a metal object vibrates on a very cold surface. What do others think?
2017/03/24 IM: I suggest that authors of these three proposals can be asked about respective effects and potential merger of the problems
2017/06/24 SB: Wording has to be adjusted such that link to youtube video can be removed.
2017/06/26 JB: I agree that the problem should not be reliant on watching a specific video.
2017/06/29 Author: Very easy to reproduce granted you have access to dry ice (CO2), which is not hard to find but has to be planned for.
Frosty Phone : rings like a phone, is cold (like frost). I'm happy if you find a better name. I think the problem should be fun and interesting.
2017/07/05 SB: In the original statement you also mention „very cold ice“. What would that mean (in terms of temperature)?
2017/07/05 Author: I have some doubts about this because the ringing is certainly caused by gas sublimation from dry ice. I would remove this statement - the students can try whether it works with normal ice or liquid nitrogen.

ID 2018-062a (2018-062)

Heron's Fountain 3.53

Construct the Heron’s fountain and explain how it works. Investigate how the relevant parameters affect the height of the water flow.

Figures:

Origins:

https://en.wikipedia.org/wiki/Heron%27s_fountain
Georgescu, Andrei-Mugur; Georgescu, Sanda-Carmen; Stroia, Liviu. Heron's fountain demonstrator. Revista Romana de Inginerie Civila5.2 (2014): 87-94.

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: ID 2018-062 "Heron's Fountain" and ID 2018-063 "Heron’s Fountain" should be merged.

ID 2018-019a **(2018-019)**

Bottle Flip 3.47

A recent trend is to attempt to throw a partially filled bottle in the air so that it completes a full backwards rotation before landing upright on a table. Investigate the relevant parameters and determine the conditions under which a bottle partially filled with water will land upright.

Figures:

Origins:

This has been a popular recent trend among my students, and evidently across the globe according to the number of hits a search on YouTube brings up. This was apparently started by this YouTube video of a high school talent show performance:
https://www.youtube.com/watch?v=GdUVtEeg9I4
It strikes me as a commonplace phenomenon involving some quite complex physics, hence potentially a good IYPT problem.

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

There is a lot of easily accessible physics in this on the mechanics side (launch speed, angle, angular velocity, etc), but also a lot of more complex physics involving the motion of the fluid in the bottle. It strikes me that consistent experimental apparatus may be difficult to achieve, but simple experiments should provide plenty of data to work with.
I am unsure whether or not to specifically mention different fluids as a parameter in the problem statement. As phrased above it is closest to the 'real life' situation, but precludes the use of liquids other than water. The end of the last sentence could be reworded as "...partially filled with liquid..." which would open up liquid parameters such as viscosity and density for investigation. If the problem were to be selected I would be happy with whatever wording the committee decided.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 SB: Merged with ID 2018-019

ID 2018-136

Waves in a Cylinder 3.47

A horizontal cylinder is partially filled with a viscous fluid. If the cylinder is rotated around its long axis, unusual fluid behavior can be observed, such as sharp cusp-like waves on the walls of the cylinder. Investigate the fluid behavior as a function of relevant parameters.

Figures:

http://fuckyeahfluiddynamics.tumblr.com/image/150493922394

Origins:

http://fuckyeahfluiddynamics.tumblr.com/post/150493922394/imagine-that-you-partially-fill-a-horizontal
http://www.seas.harvard.edu/softmat/downloads/pre2000-13.pdf

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

FYFD describes the phenomenon and possible effects in the following manner, "Imagine that you partially fill a horizontal cylinder with a viscous fluid, like corn syrup or honey. If that cylinder is still, the fluid will simply pool along the bottom. On the opposite extreme, if you spin it very fast, that cylinder will become coated in an even layer of fluid that rotates along with the cylinder thanks to centrifugal force. Between those two extremes in rotational velocity, some interesting fluid behaviors occur. Start spinning the cylinder and some of the pooled fluid will be pulled up the sides, eventually forming a thicker film with a straight front along the bottom of the cylinder. Spin faster and that straight front starts to break down, forming sharper cusp-like waves known as shark teeth."
The problem refers to a complex, but easily produced hydrodynamic effect. Some aspects of the problem are well known, while other aspects have been reported in literature only recently. A large number of parameters can be controlled and many types of flow regimes and instabilities can be observed. The cylinder obviously needs to be transparent.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well), I trust literature or information from my colleagues that the problem is apparently feasible at the IYPT level

Discussion:

2017/06/26 JB: I am not sure that ‘long axis’ is entirely correct here but I know what the author means.
2017/06/29 SB: Can we just delete the word “long”? In my opinion this is the only axis of a cylinder.

ID 2018-002

3D Hologram 3.40

Construct 3D hologram using smartphone and plastic pyramid. Investigate its properties

Figures:

Origins:

https://youtu.be/7YWTtCsvgvg

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/06/24 SB: The video seems to refer to a particular app.
2017/06/24 SB: Without the video the problem statement is quite unclear.
2017/06/24 SB: 1 IOC members has doubts about the feasibility.
2017/06/24 IM: The effect is a combination of very basic optics (reflection and refraction, nothing else) and smartly designed algorithms that calculate the picture on the phone screen. In terms of being surprising and fascinating, and in terms of teaching computer-generated imagery, the problems is good. In terms of challenging physics, I am not so sure.
2017/06/26 JB: I agree with the limitations of this problem but maybe it is quite interesting in a way.

ID 2018-014

Balls in a Ball 3.40

Place a number of small identical ball bearings in a transparent hollow sphere and start their motion on the inner surface of the sphere by manipulating the sphere. Investigate the conditions under which the different possible types of motion that can be achieved.

Figures:

Refer to links provided in earlier question.

Origins:

https://en.m.wikipedia.org/wiki/IBall_(toy)
https://www.instagram.com/p/BRyjd-EBaeC/?taken-by=physicsfun

I saw this toy online and thought the patterns produced are quite interesting!

Novelty:

I am not sure whether a similar problem has been at the IYPT in the past

Comments:

The scope of this problem should be limited to the cases where the ball bearings remain in contact with the larger sphere.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: I am not quite sure, but it seems as if ID 2018-014 "Balls in a Ball" and ID 2018-116 "Strange Change of Rotation" should be merged.
2017/04/14 SB: They seem to be sufficiently different to me.
2017/04/15 JB: Yes - sufficiently different.
2017/06/24 SB: 1 IOC member has doubts about the feasibility.
2017/06/26 JB: Do we know the nature of these ‘doubts’?
2017/06/29 SB: Unfortunately we don’t …
2017/06/29 SB: The toy shown in the video is no longer produced. This is the only evidence the author can give that it works. Does it seem to be feasible for the students to build the device themselves?

ID 2018-019c **(2018-132)**

Water Bottle flip 3.40

Flipping a water bottle - in which a water bottle is thrown so that it rotates and lands the right way up - went viral in 2016 with many videos of the trick. Investigate the parameters which affect the success of the trick and determine under which conditions the trick is most likely to be successful.

Figures:

Origins:

Viral water bottle flip videos, e.g. https://www.youtube.com/watch?v=fbaB8sSe3YA

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

http://www.vox.com/2016/5/26/11785562/water-bottle-flip-physics

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 SB: Merged with ID 2018-019

ID 2018-019d **(2018-133)**

Water Bottle Flip Challenge 3.40

A challenge called "Water bottle flip challenge" that involves throwing a plastic water bottle, typically full or partially full of liquid, into the air so that it rotates, in an attempt to land it upright on its bottom has recently become international trend. Describe the bottle rotation dynamics and investigate which of relevant parametres help perform this challenge successfully.

Figures:

Origins:

https://en.wikipedia.org/wiki/Water_bottle_flipping

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: This too has to be merged with ID 2018-019, ID 2018-131, and ID 2018-132

ID 2018-029

Color of Powders 3.40

If a colored material is grinded, in some cases the resulting powder may change color or appear colorless. Investigate how grinding degree effects the apparent color of a powder.

Figures:

Origins:

Own idea, but otherwise a known observation.

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

This problem bears remote similarities with 16. Wet and dark (2015) -- both have to do with multiple reflections and refractions of light in disperse medium. As many parameters can be controlled in experiments and many optical properties can be recorded, this problem can be particularly interesting from experimental and theoretical point of view.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/04/15 JB**:** I would be happier if the type of material used was specified or it becomes too broad a topic..
2017/06/24 IM: This can be plastic, crystals of some salts, glass etc. I don't think the effect would significantly depend on the chemical composition of the materials. The material needs to have a degree of transparency, a color, be solid, and not too hard to mill in a coffee grinder (or a similar mill). Varying these parameters is a part of the task, I would assume.
2017/06/26 JB: Yes - I immediately think of grinding something like copper sulfate that starts out deep blue and becomes nearly white when finely ground.

ID 2018-035a **(2018-035)**

Dancing Coin 3.40

Take strongly cooled bottle and put on its bottleneck a coin. Over time you will hear a noise and see coin movements. Explain this phenomenon and investigate how the relevant parameters affect the dance (friction, jumping height etc.).

Figures:

Origins:

https://www.youtube.com/watch?v=3TjcbvmjqIA

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: ID 2018-035 "Dancing Coin", ID 2018-054 "Frosty Phone" and ID 2018-127 "Trevelyan's Rocker" can be about the same effect and, if so, should be merged. The geometry of the vibrating objects is not the same, and the sounds in youtube videos are not similar. But in each case a metal object vibrates on a very cold surface. What do others think?
2017/03/24 IM: I suggest that authors of these three proposals can be asked about respective effects and potential merger of the problems

ID 2018-062b **(2018-063)**

Heron’s Fountain 3.40

Scheme of Heron's fountain is given in Figure 1. Describe how the apparatus works and explain how different parameters influence the fluid behaviour.

Figures:

https://www.rose-hulman.edu/~moloney/AppComp/2001Entries/e09k/fountain91pct.gif

Origins:

https://arxiv.org/pdf/physics/0310039.pdf
https://www.youtube.com/watch?v=5_Pbb1Ywo18

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well), I trust literature or information from my colleagues that the problem is apparently feasible at the IYPT level

Discussion:

2017/03/23 IM: ID 2018-062 "Heron's Fountain" and ID 2018-063 "Heron’s Fountain" should be merged.

ID 2018-122

Tesla Valve 3.40

A Tesla Valve is a fixed-geometry passive one-direction valve. A Tesla Valve offers resistance 10-200 times greater in one direction compared to the other, in which the flow is turbulent. Create and investigate the relevant parameters of such a Tesla Valve!

Figures:

https://en.wikipedia.org/wiki/Tesla_valve#/media/File:Tesla_valve_cross-section.png
https://en.wikipedia.org/wiki/Tesla_valve
https://www.youtube.com/watch?v=ozFBsMyyDSE
https://www.youtube.com/watch?v=rYlP5TEKf2w

Origins:

Lecture on the local Technikal University.
Wikipedia, Youtube

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

With a 3D printer it seems to be a childs play to create such a valve. Without it with some creativity it seems to be creatable.

Feasibility:

I trust literature or information from my colleagues that the problem is apparently feasible at the IYPT level

Discussion:

2017/06/26 JB: As I believe I mentioned earlier, this is a great problem if you have a 3D printer but maybe not so easy if you don't!
2017/06/29 SB: Instructions for "handmade" wooden valves can also be found, so this shouldn't be too much of a problem.

ID 2018-040

Drinking Straw 3.33

When a drinking straw is placed in a vessel of carbonated drink it can rise up, sometimes falling from the vessel. Investigate and explain the motion of the straw and determine the conditions under which the straw will fall from the vessel.

Figures:

Origins:

The idea for this problem arose sitting in a restaurant with the NZ team in Yekaterinburg after round 5 of IYPT 2016. Waiting for our meals several of us sat in a physics induced daze and watched as a straw in a glass of sprite gradually floated higher and higher, tipping over more and more, until eventually it fell out of the glass onto the table. Having just spent the last four days watching physics fights three of us had the same idea - "That would be a good IYPT problem!"

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

I feel this problem is achievable at a range of levels. At a simple level the concepts of buoyancy, torque, surface adhesion, static and dynamic friction all apply and could be used to explain the phenomenon.
At a higher level the influence of the rate of bubble formation at different depths, rate of change of force and torque as the angle and submerged depth change, the slip-stop motion as the straw rises (initial observations suggest it is not a continuous process), the static and/or sliding friction with both the wet surface inside the glass and the dry(?) surface on the rim of the glass could all be explained and possibly modeled mathematically.
Experimentally there are several relevant parameters to investigate such as fluid parameters (carbonation, temperature, etc), straw parameters (mass, length, diameter, material, etc), and vessel parameters (height, diameter, material, shape, surface condition, etc).

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-043

Dusty Windows 3.33

Windows usually become dirty due to small dusty particles which stick to them. On the contrary, large enough particles (e.g. gravels) hardly stick the windows. What defines the critical size, dividing these two regimes? Investigate the relevant parameters.

Figures:

Origins:

personal observation

Novelty:

I am not sure whether a similar problem has been at the IYPT in the past

Comments:

Feasibility:

I am not sure how feasible is the problem from the IYPT perspective

Discussion:

2017/06/26 JB: Difficult but not impossible I think

ID 2018-088

Open Siphon Effect 3.33

The behavior of non-Newtonian fluids can often seem paradoxical. Besides a strange behavior at impact, such liquid may spill out on its own. Explain the causes of this effect called open siphon effect and explore which fluid parametrs affect the speed of outflow.

Figures:

Origins:

https://www.youtube.com/watch?v=g4od-h7VoRk
http://authors.library.caltech.edu/57412/

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/06/24 SB: Does the effect work with fluids available to highschool students?
2017/06/24 IM: The video mentions an 0.5% solution of poly(ethylene oxide). A package of 5 grams of this compound (dry) costs 49.20 EUR via http://www.sigmaaldrich.com/materials-science/material-science-products.html?TablePage=20204232. This amount is enough to make around 1 L of the fluid. Not too cheap, but probably poly(ethylene oxide) is available already in chemistry labs of the schools? My feeling is that overall, this is feasible in terms of chemicals and equipment.
2017/06/26 JB: I think that 49.20 EUR is prohibitively expensive for some schools.
2017/06/30 Author: As written in Wikipedia: "A non-Newtonian fluid is a fluid that does not follow Newton's Law of Viscosity. Most commonly, the viscosity (the measure of a fluid's ability to resist gradual deformation by shear or tensile stresses) of non-Newtonian fluids is dependent on shear rate or shear rate history". So, for example, you can use an aqueous solution of starch in a ratio of 1:3 in favor of water, because it does not mean, what are the components, starch or PEO or something else, of a non-Newtonian fluid, but it is important that this fluid is the non-Newtonian by definition. The phenomenon of the effect of open siphon is also reproduced with this composition of the liquid (not only with PEO), I have done it by myself. It should be said that it is interesting to observe the movement of fluid (it is alike Newton beads) depending on the concentration of starch (or PEO). Also as the components of the non-Newtonian fluid can be used baking soda and sodium tetraborate together, but i have not tried them yet for. It might be a good stroke in a solution of this phenomenon, i think.

ID 2018-101

Seismograph 3.33

Construct a simple seismograph amplifying a local disturbance by mechanical, optical or electrical methods. Determine the typical response curve of your device and investigate the specific parameters of the damping constant. What is the maximum aplification you can achieve?

Figures:

Origins:

Google search for "simple seismograph" reveals several very easy principles for mechanical seismographs. Many of them could be easily enhanced by a electrical read-out unit resulting in a higher overall sensitivity.

Additionally, the typical amplification characteristics of professional seismographs are well-clasified as given by the following reference:
http://www.seismo.com/msop/msop79/inst/inst1.html

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Building the seismograph will be possible for all IYPT teams all around the globe. Also, testing the setup under the influence of noise or other sources of disturbances can be done by students.

I fixed the phrasing to the methods stated above as this would allow the use of:
- all mechanical devices found by an easy google search
- measuring using light barriers or interferometric principles
- electrical amplification (also adding side-effects to the characteristic ampl. curve)

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-137

Weighing Time 3.33

It is commonly known that an hourglass changes its weight (as measured by a scale) while flowing. Investigate this phenomenon.

Figures:

Origins:

Well-known phenomenon

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

The force on the scale is affected by the accelerated motion of the hourglass's centre of mass. Students are expected to come up with a model for the flow dynamics (e.g. sand) and predict the force vs. time characteristic for the hourglass. Parameters that could be varied include: size/shape of hourglass, flowing medium (e.g. sand)

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/06/24 SB: 1 IOC member has doubts about the feasibility. I found a reference where an experimental setup that leads to measurable results is described (http://aapt.scitation.org/doi/pdf/10.1119/1.4973527).
2017/06/24: My opinion is that this problem is quite feasible in terms of equipment and measurement techniques.

ID 2018-027

Cloak of Invisibility 3.27

It is possible to make an object invisible using a simple set of lenses and/or mirrors that transmits the light from the background to the observer along a trajectory not hitting the object. Create such system and investigate its properties.

Figures:

Origins:

Various possible solutions can be found on the Internet, e. g.
https://www.youtube.com/watch?v=Pdr8wb4Ip2E
https://www.youtube.com/results?sp=SFDqAwA%253D&q=amazing+optics
or
https://www.youtube.com/watch?v=CRUoZPBwZ8Y

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Few basic concepts can be easily found. The students are expected to build a working device and optimize it to achieve best results.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/06/26 JB: My criticism would be that the physics is trivial.
2017/06/29 SB: The idea probably is, but (as it states in the problem) it's more about investigating the properties (e.g. distortions, parts that can't be hidden, etc.). It sounds like a popular IYPT problem, anyway.

ID 2018-018

Blowing Bubbles 3.20

By blowing on a liquid film, after a critical flow rate a bubble may be formed. After the bubble has been formed, the liquid film may pop or continue to exist as a thinner film. How many bubbles can be produced from a single film? How does the thickness and size of the bubble vary after each successive bubble formation? Investigate the number of bubbles produced from a single film and the change in the characteristics of the bubbles in accordance to the relevant parameters.

Figures:

http://orig04.deviantart.net/3ba3/f/2010/034/3/f/blowing_bubbles_by_xsweetprincess.jpg

Origins:

[1] L. Salkin, et al. "Generating soap bubbles by blowing on soap films",
Phys. Rev. Lett. 116, 2016
[2] L. Courbin, H. Stone, "Impact, puncturing, and the self-healing of soap films", Phys. Fluids 18, 2006

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-030b **(2018-099)**

Sandpile 3.20

Set a steady slow trickle of loose dry sand on a hard surface. As the sandpile grows, avalanches would occur of either consistent or widely variable size. Investigate the dependence of avalanche statistics on relevant parameters.

Figures:

Origins:

A combination of an analytical model and several experimental papers:
http://pm-matura2012.jimdo.com/sandpile-experiment/kurze-einf%C3%BChrung/
http://www.johnboccio.com/courses/SOC26/55060283.pdf
https://www.researchgate.net/publication/252164461_Self-organized_criticality_An_experiment_with_sandpiles
https://en.wikipedia.org/wiki/Abelian_sandpile_model

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before, There was a similar IYPT problem in the past, but I endorse the new proposal as interesting and important

Comments:

The big question here is whether the avalanches have consistent size or a power law distribution of avalanche sizes. The references suggest that both scenarios are possible in different parameter ranges. The famous BTW model is a highly idealized version of the sandpile with uncontrolled approximations, so its predictions aren't realized very robustly.

There was a similar problem Avalanche - #3 IYPT 2005. The significant difference is that the new problem focuses on statistics of many avalanches rather than conditions for one.

Feasibility:

I trust literature or information from my colleagues that the problem is apparently feasible at the IYPT level

Discussion:

2017/03/23 IM: They are not exactly the same, but I would strongly consider merging ID 2018-030 "Conical Piles" and ID 2018-099 "Sandpile"
2017/04/15 JB: I think this problem is OK and not too similar to previous problems.

ID 2018-097

Ring Oiler 3.20

An oiled horizontal cylindrical shaft is rotating around its axis with constant speed. Make a light flat cardboard ring with the inner diameter roughly twice the diameter of the shaft and put the ring on the shaft. Depending on the tilt of the ring, it can travel along the shaft in either direction. Investigate the phenomenon.

Figures:

Origins:

Originates from my own obervation in a historically-reconstructed village. Apparently, such devices were used to evenly spread oil along a long spinning shaft. Video from the original setup:
https://youtu.be/FXULCKpbQWI

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Rather simple mechanical problem on friction and rotational motion.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-051

Flexible Ribbon 3.13

A flexible sheet of material (metal for example) is bent to form a curved shape and the ends are secured. A mass is placed on the bent sheet which is then pushed to one side and released so that it oscillates side to side (see diagram). Investigate and explain the motion of the mass and it's dependence on relevant parameters.

Figures:

https://www.dropbox.com/s/i251iqog32mqnn4/Bent%20sheet.png?dl=0

Origins:

The origin of this problem is from a quite well known (and entertaining) youtube video of some goats playing on a metal sheet:
https://www.youtube.com/watch?v=58-atNakMWw
The suggested title of the problem is from the title of the youtube video.

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

This strikes me as a problem achievable at a range of levels. It is easily accessible experimentally, with only simple equipment needed. I have tried it myself using only a strip of paper and paper clips and achieved the phenomenon in only a few minutes. However, it also has the potential for complex mathematical modelling for more advanced students.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: Merge with ID 2015-095 "Oscillating Sheet" and ID 2016-110 "Semicircular flex".

ID 2018-061

Hearing Temperature 3.13

Pouring hot water makes a distinctly different sound than pouring cold water. How is the sound different and why? How precisely can you measure temperature based on this effect?

Figures:

Origins:

https://www.youtube.com/watch?v=Ri_4dDvcZeM

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well), I trust literature or information from my colleagues that the problem is apparently feasible at the IYPT level

Discussion:

ID 2018-106

Shell Polygons 3.13

Apply localized pressure to an elastic spherical shell, such as a ping pong ball. Often the deformation of the shell will take shape of a regular polygon. Investigate how the shape of the indentation depends on the relevant parameters.

Figures:

Origins:

There is a research group that studies the deformations of materials that are highly nonlinear due to geometry, rather than large stretching. They have several articles on the polygonal deformations and other effects.
http://web.mit.edu/preis/www/mypapers/jam_081_12_121008_Scones_NastoReis_2014.pdf
http://web.mit.edu/preis/www/mypapers/reis_SoftMatter_SCones_2013.pdf
http://web.mit.edu/preis/www/research.html

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

The emergence of discrete rotational symmetry is somewhat similar to Leidenfrost Stars of 2017. However, there haven't been many problems on nontrivial elastic deformations.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-134

Water Jet Flower 3.13

When a water jet falls on a flat but not too smooth surface, a distinctive circular pattern can be observed around the point of impact. Investigate its formation and identify relevant parameters.

Figures:

https://drive.google.com/open?id=0B-1fY5kGAk6rdWpzeV9PNVpIaHdGYUNwa2EwMlkxWTlGSTFB

Origins:

I noticed the phenomenon when washing dishes - especially an uneven chopboard. So far I know of no other source.
However, a group of my students is currently investigating the phenomenon in their science fair project.

Novelty:

I am not sure whether a similar problem has been at the IYPT in the past

Comments:

So far, we were able to explain the pattern as overlapping conic waves in the thin water film. These form around small bumps in the surface and get broader as the water slows down when expanding around the point of impact. With this theory, one can get a good approximation of the actual pattern. However, critical parameters such as the thickness of the film and the roughness of the surface could not be measured.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/04/14 SB: Is this something else than the hydraulic jump? If not, I suggest to reject the problem.
2017/04/14 IM: Yes, as seen in the photo, the problem is about intersected capillary waves that develop on surface irregularities. Hydraulic jump is an unrelated effect.
2017/06/24 SB: 1 IOC member has doubts about the feasibility.

ID 2018-010a (2018-010)

Artificial Chemotaxis 3.07

Prepare mixtures of water with food coloring containing propylene glycol in several different concentrations. Prepare a clean glass slide and place small droplets of different mixtures on it. The droplets will demonstrate a complicated movement involving chasing and merging. Investigate the phenomenon.

Figures:

Origins:

I can across this problem in a press release from Stanford on a Nature paper:
https://engineering.stanford.edu/news/stanford-engineers-solve-mystery-dancing-droplets
http://www.nature.com/nature/journal/v519/n7544/full/nature14272.html
Vapour-mediated sensing and motility in two-component droplets, N. J. Cira, A. Benusiglio & M. Prakash, Nature 519, 446–450 (26 March 2015)

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

The mixture droplets in this experiment can "sense" each other, akin to chemotaxis phenomenon in bacteria. The range of possible behaviors is very large. The composition of the mixture of two liquids with imperfect mixing is essential for the effect. It is also very easy to control droplets behavior by drawing "walls" on the glass with a regular marker.

Feasibility:

I trust literature or information from my colleagues that the problem is apparently feasible at the IYPT level

Discussion:

2017/03/23 IM: ID 2018-010 "Artificial Chemotaxis" and ID 2018-025 "Chasing Droplets" should be merged with ID 2017-036 "Fluidic Calculator".

ID 2018-016

Bernoulli, Coanda or Something Else 3.07

Place a ping-pong ball hanged on a thread under a thin vertical water jet. The ball is drawn into the jet. Explain and investigate this phenomenon.

Figures:

Origins:

well-known effect

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

this effect is well-known, but its explanation is not simple. What is the impact of Bernoulli principle? of Coanda effect? of surface tension?

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-064

Hit, One More Hit! 3.07

Investigate how does the frequency of rotation of a radiometer depend on the light intensity. Using the results of your investigation suggest a method for measurement of the density in radiometer.

Figures:

Origins:

Novelty:

Comments:

Feasibility:

Discussion:

2017/03/23 IM: Merge with ID 2015-076 "Light mill".
2017/06/24 SB: Are radiometers with variable pressure readily available?
2017/06/24 IM: Probably you cannot buy one. But it should be quite feasible to connect the glass bulb to a pump and a pressure gauge. It is quite feasible to replace the glass bulb as well, such that it has a larger volume and more easily connected to a pump.
2017/06/26 JB: This would be a real problem for schools without decent vacuum equipment.

ID 2018-066

Human Voice 3.07

Research, construct and evaluate a mechanical device that closely mimics the operation of the human speech apparatus. Make your device say “I-Y-P-T”.

Figures:

Origins:

First proposed several years ago but not selected

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Could be an 'Invent Yourself' problem

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/06/24 SB: More of an engineering task. What is the physics we expect?
2016/06/24 IM: Probably some discussion about acoustic analysis and oscillation modes.

ID 2018-069

Inspirited Particles 3.07

When a fine chalk powder is sprinkled on the surface of ethanol, the particles at the surface perform quick, erratic movements, as though they suddenly were alive. Investigate this phenomenon.

Figures:

http://nicochevalier.net/wp-content/uploads/2016/09/agitation_ethanol.jpeg

Origins:

Noticed this in an experiment

Novelty:

I am not sure whether a similar problem has been at the IYPT in the past

Comments:

The phenomenon is visually very eye-catching. It is easy to understand at a basic level and challenging to grasp quantitatively the overall pattern of motion. Topics addressed: solution behaviour, fluid dynamics, surface tension. Using different liquids or particles reveals a very rich phenomenology.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-089

Origami 3.07

Origami is the Japanese art of creating complicated figures by folding a flat sheet of paper. When the folds form a regular pattern such as the Miura fold, the whole structure may exhibit unusual mechanical properties, such as negative Poisson's ratio. Design and study an origami fold with this property.

Figures:

Origins:

Similar folding mechanisms were used for solar panels installed on the International Space Station. There is quite a bit of academic research on this and other regular folds:
https://en.wikipedia.org/wiki/Miura_fold
http://www.markschenk.com/research/files/PhD%20thesis%20-%20Mark%20Schenk.pdf
http://www.markschenk.com/research/files/poster_folded_shell_structures_vitae_web.pdf

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

There has been a number of problems investigating mechanical properties of paper in the past years, but none have focused on the Poisson ratio (the relation of contraction or expansion along different spatial axes).

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-103

Semiautomatic Screwdriver 3.07

Take a strong magnet and attach a screwdriver to it so that it can swing below. Hold the magnet and spin the screwdriver. After it stops surprising effect happens - it starts spinning in opposite direction on its own. Explain and investigate this effect.

Figures:

Origins:

Personal observation. Repeated multiple times. No explanation found yet.

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Experiments are easily feasible and electromagnetism problems are rare.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/04/15 JB: Would need to be verified.

ID 2018-010b **(2018-025)**

Chasing Droplets 3.00

Place small water droplets with various amounts of propylene glycol (e.g. as in food colouring) next to each other on a clean glass slide. Some droplets will move towards others and push them away. Explain this phenomenon and investigate how the relevant parameters affect their motion.

Figures:

Figure 1 a and b of the paper cited above

Video No 9 of this paper

Origins:

Vapour-mediated sensing and motility in two-component droplets
N. J. Cira, A. Benusiglio & M. Prakash, Nature, Vol 519, p446 (2015)

and supplementary information to this paper.

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well), I trust literature or information from my colleagues that the problem is apparently feasible at the IYPT level

Discussion:

2017/03/23 IM: ID 2018-010 "Artificial Chemotaxis" and ID 2018-025 "Chasing Droplets" should be merged with ID 2017-036 "Fluidic Calculator".

ID 2018-050

Fizzyness Detector 3.00

The clinking sound of two glasses filled with a drink significantly depends on whether the drink(s) are fizzy. Construct a device that measures the level of “fizzyness” of the drinks in an appropriate measure and optimize its sensitivity.

Figures:

Origins:

Own observations and basic experiments.

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

It is easy to observe the effect and make basic experiments. Binary detection is rather easy to establish. On the other hand, giving more elaborate on the amount of CO2 stored in the drink seems to be highly non-trivial, opening a further deepness of the problem.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/06/24 SB: 1 IOC member has doubts about the feasibility.

ID 2018-094

Radiant Lantern 3.00

If you take a picture of a glowing lantern at night, a large number of rays emanating from the center of the lantern will turn out on the pictures. Explain and investigate this phenomenon.

Figures:

https://pp.vk.me/c837736/v837736285/1918b/wsuKHsEhsUc.jpg
https://pp.vk.me/c837736/v837736285/19380/eDGpVOsPFGE.jpg

Origins:

https://www.getaclass.ru/edu/vency-i-korony
IYPT 2012 Misty glass

Novelty:

There was a similar IYPT problem in the past, but I endorse the new proposal as interesting and important

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/24 IM: Merge with ID 2015-077 "Light Rays"

ID 2018-013

Ball and Cups 2.93

Cover of the release №.11 (2016) magazine "Quantico":

Take a balloon and two light plastic cups. Begin inflating the balloon and, when it has taken a round shape but still not much inflated, press cups firmly to it on both sides. Now inflate the ball harder and release hands. Cups have not fallen! Explore this phenomenon and determine which relevant parameters depends on the interaction force between the ball and the cup. How can it be increased?

Figures:

Origins:

http://kvantik.com/files/kvantik_2016_11_sample.pdf

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-032

Crooked Dice 2.93

The probabilities of resting positions for a so called crooked die are not equal. Test various methods to produce such a die. How does its dynamics depend on the relevant properties? How many rolls or throws are sufficient to say whether a die is crooked?

Figures:

Origins:

Own wording and idea, but loaded dice are well known.

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Simple methods to load a die: http://www.wikihow.com/Load-Dice
Some discussions about testing a die:
http://www.askamathematician.com/2014/08/q-how-many-times-do-you-need-to-roll-dice-before-you-know-theyre-loaded/, http://mathforum.org/library/drmath/view/60432.html
This problem is an easy starter but would involve complex mechanics and simulations. The question about the number of test rolls brings another important aspect: analysis of discrete probabilities, statistical tests, and confidence thresholds. While altering the weight distribution is the simplest method, the problem directly encourages to study other methods (e.g. shaving edges.) A reporter can as well discuss the limits for a human not to say, at first glance, that the die is tampered.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-047

Eulers Magnets 2.93

Make a stack of small neodymium magnets and hold them to a horizontal shelf, using more magnets on the other side. Rotate the stack, like a conical pendulum, and you should see that the stack of magnets rotates with a gradually decreasing period, similarly to Euler's disc. Investigate the parameters that affect the motion of the magnets and how the motion changes with time.

Figures:

Origins:

https://www.youtube.com/watch?v=KJHlwJ1gsms

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Although there are similarities with Euler's disc I think there are enough differences (the direction of gravity is a variable, as is the distance between the magnets, the strength of the magnets, the centre of mass of the magnets and the material used to make the shelf).

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: Not entirely sure, but perhaps should be merged with ID 2017-055 "Magnetic Disk"

ID 2018-058

Gulping Bottle 2.93

Pouring a liquid out of a bottle with a quite long and thin neck, bubbles of air are regularly soaked into the bottle.

Investigate the phenomenon and the relevant parameters influencing the size of the bubbles and the frequency they are soaked in.

Figures:

Origins:

This is a phenomenon I see several times a day, already for years, but actually never noted something special about this until I started to think about the origin of this quite interesting phenomenon a few weeks ago.

Novelty:

I am not sure whether a similar problem has been at the IYPT in the past

Comments:

Actually it is quite easy to find the basic explanation and it should also be not too difficult to find a quantitative theory looking at the pressure (thermodynamics and hydrostatic pressure) and considering the fluid dynamical instability at the surface.
Research for this topic was not very fruitful (but maybe I just searched for the wrong key words). The results were only similar questions (but anyways with some helpful answers):
http://www.scienceforums.net/topic/67200-why-does-liquid-poor-in-gulps/
http://physics.stackexchange.com/questions/103766/why-does-water-gulp-out-of-a-water-bottle-with-a-narrow-opening-instead-of-a-ste
But actually this opens the possibilities to own research, which should be quite feasible, as the single components of the problem are well known.
And experiments are not difficult at all. The only difficulty I can imagine is to measure the size of the bubbles.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-068b (2018-102)

Self-Inflating Balloon 2.93

Kamifusen, a popular Japanese toy, is a paper balloon 10-20 cm in diameter that has a small hole. When bounced by hand up and down, kamifusen spontaneously slowly inflates. Investigate and explain the phenomenon.

Figures:

Origins:

Based exclusively on a popular article in Physics Today:
http://physicstoday.scitation.org/doi/10.1063/PT.3.3437
https://www.youtube.com/watch?v=pkrlPFPEyPE

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

I couldn't find this experiment repeated elsewhere and don't have the right materials to reproduce it. The explanation of self-inflation in the article seems plausible, but lacks derivation details. The effect is very interesting, however.

Feasibility:

I trust literature or information from my colleagues that the problem is apparently feasible at the IYPT level

Discussion:

2017/03/23 IM: ID 2018-068 "Inflating Kamifusen" and ID 2018-102 "Self-Inflating Balloon" should be merged.

ID 2018-075

Levitation 2.93

Superconducting materials are known to be able to levitate above the surface of a strong permanent magnet. It is said that this feature is also demonstrated by pyrolytic graphite (or pyrolytic carbon) under room temperatures. Demonstrate, investigate and explain this phenomenon.

Figures:

Origins:

General research.

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before, There was a similar IYPT problem in the past, but I endorse the new proposal as interesting and important, I am not sure whether a similar problem has been at the IYPT in the past

Comments:

Repulsion of two magnets is easy to demonstrate and show theoretically. The shape of magnetic field of permanent magnets however does not allow finding a stable levitating position without suspension in one of the axes, as the dipole or a more complicated magnetic shape would always turn around. Superconducting materials, in contrast, do levitate as their magnetic field is induced by the permanent magnet and as such always points in the opposite direction.
Pyrolytic graphite is said to be a material having such diamagnetic properties at room temperatures that it allows for levitation as well. It is easily available on different e-shop sites under reasonably prizes (around 5 EUR).
Within the problem, students are supposed to demonstrate the levitation, explain the phenomenon on qualitative level in more elaborate solutions investigate the lifting capacity with different magnets, stability etc.

Feasibility:

I trust literature or information from my colleagues that the problem is apparently feasible at the IYPT level

Discussion:

ID 2018-095

Raindrops 2.93

Is the tear-shaped raindrop a myth? Investigate and explain the shape of raindrops.

Figures:

http://imgur.com/a/KXW56

Origins:

http://meetingorganizer.copernicus.org/EGU2013/EGU2013-13122.pdf

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-116

Strange Change of Rotation 2.93

If you place a number of balls in a cylindrical vessel then when you swirl the vessel the direction of movement of the ball depend on the number of balls inside (small number behaves different than large number of balls). Investigate and explain this effect.

Figures:

Origins:

A youtube video
https://www.youtube.com/watch?v=QFeG9CeeH88

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: I am not quite sure, but it seems as if ID 2018-014 "Balls in a Ball" and ID 2018-116 "Strange Change of Rotation" should be merged.
2017/04/14 SB: They seem to be sufficiently different to me.
2017/04/15 JB: We clearly would not want more than one of these problems in a tournament but they are worth sending to the vote.

ID 2018-012

Backwards Tea 2.87

Under what circumstances can particles flow upstream, such as tea leaves flowing from a cup into a teapot?

Figures:

https://www.sciencenews.org/article/particles-defy-gravity-float-upstream

Origins:

http://rspa.royalsocietypublishing.org/content/469/2157/20130067
http://rspa.royalsocietypublishing.org/content/royprsa/suppl/2013/06/27/rspa.2013.0067.DC1/rspa20130067supp1.pdf
http://arxiv.org/abs/1105.2585v1

Novelty:

I am not sure whether a similar problem has been at the IYPT in the past

Comments:

Fluid dynamics combined with tea-drinking - such fun.

Feel free to change problem wording etc.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-035c **(2018-127)**

Trevelyan's Rocker 2.87

A metal object with two small ridges (a rocker) is heated and placed on a cold lead block so that the rocker rests on the two ridges. Investigate the properties of the sound produced as a function of relevant parameters.

Figures:

I couldn't find any good figures when googling this, and maybe one is needed? But if the name Trevelyan is included in the problem title or text it should be easy for students to find out what one looks like from videos etc.

Origins:

https://www.youtube.com/watch?v=U23iwbVX-Dk
http://journals.aps.org/pr/abstract/10.1103/PhysRev.22.517
https://www.youtube.com/watch?v=D51nazEkutE

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

This problem would do well with an illustration of the setup, with the ridges being against the lead. It is an old physics demonstration but there seems to be a lot of parameter variation that could be done and it seems to be easily achievable. Some schools/universities will have some version of this already that can be used for initial testing. It is possible to make a rocker using a copper tube.

This to test would be rocker material, shape, distance between ridges, temperature of rocker, temperature of lead, shape of lead block, pressure on rocker (should change pitch), sound variations over time.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: ID 2018-035 "Dancing Coin", ID 2018-054 "Frosty Phone" and ID 2018-127 "Trevelyan's Rocker" can be about the same effect and, if so, should be merged. The geometry of the vibrating objects is not the same, and the sounds in youtube videos are not similar. But in each case a metal object vibrates on a very cold surface. What do others think?
2017/03/24 IM: I suggest that authors of these three proposals can be asked about respective effects and potential merger of the problems

ID 2018-065

Hula Hoop Dynamics 2.87

A hula hoop that it twirled around a person's body can be kept at about the same height for a long time, or even move upwards and downwards while spinning. Investigate the dynamics of such a hula hoop and its dependency from relevant parameters, such as material properties, diameter of the hoop and movement of the person's body.

Figures:

Origins:

http://www.madehow.com/Volume-6/Hula-Hoop.html
https://en.wikipedia.org/wiki/Hula_hoop

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

It's a popular and well known toy that offers interesting dynamics to investigate; easy to perform experiments with cheap and easily available equipment

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: Merge with ID 2014-40 "Hula hooping"

ID 2018-068a **(2018-068)**

Inflating Kamifusen 2.87

The Japanese toy, Kamifusen, is a light spherical balloon made out of glassine segments. Even though the Kamifusen possesses a hole it does not deflate when it bounces, but can even be further inflated. Explain this effect and investigate the parameters that govern this effect.

Figures:

Origins:

I saw the following article on Physics today:
http://physicstoday.scitation.org/doi/pdf/10.1063/PT.3.3437

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

The equipment can easily be obtained and the effect is also not hard to observe. However, in my view the study presented is still very incomplete and only qualitatively touch upon the phenomenon. I definitely believe that further work can be done by the IYPT-participants.

The problem is an interesting seemingly counter-intuitive thermodynamics/statistical physics phenomenon.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: ID 2018-068 "Inflating Kamifusen" and ID 2018-102 "Self-Inflating Balloon" should be merged.

ID 2018-070b (2018-109)

Smart Phone Screen 2.87

When a laser is directed towards the screen of a smart phone a diffraction pattern can be observed in the reflected light. Investigate how the patterns depend upon the various parameters of the situation.

Figures:

Origins:

Article byScherer and Cousins in"The Journal of the Australian Science Teachers Association" December 2016

Novelty:

I am not sure whether a similar problem has been at the IYPT in the past

Comments:

The diffraction pattern seems to be created by the pixels in the screen and the pixel size can be determined.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: ID 2018-070 "iPhone" and ID 2018-109 "Smart Phone Screen" should be merged.

ID 2018-017

Bicycle Stabilty 2.80

It is often argued that bicycles are stable due to the gyroscopic effect. However in reality, other effects play an important role as well. Investigate the conditions for a bicycle to remain stable, depending e.g. on the wheels' diameter and mass, their thickness and material, the speed, and the geometry and mass distribution of the bike.

Figures:

Origins:

https://en.wikipedia.org/wiki/Bicycle_and_motorcycle_dynamics
http://ezramagazine.cornell.edu/SUMMER11/ResearchSpotlight.html
https://janheine.wordpress.com/2011/04/27/bicycle-stability-everything-works-together/
http://bicycle.tudelft.nl/stablebicycle/
http://www.popularmechanics.com/adventure/sports/a6602/physics-of-a-riderless-bike/

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

A very basic every day question with recent research available, but not fully solved; easy to perform experiments; interesting aspects to be considered

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/24 IM: Merge with ID 2014-02 "Bicycle"

ID 2018-036

Dead Water Phenomenon 2.80

When a ship travels through multi-layered water, it might slow down or even completely stop. Make a model experiment, analyse the necessary conditions for this effect to happen and explain the phenomenon.

Figures:

Origins:

O.V. Motygin, N.G. Kuznetsov: The Wave Resistance of a Two-Dimensional Body Moving Forward in a Two-Layer Fluid. Journal of Engineering Mathematics, 32: 53 (1997)

Demonstration: https://www.youtube.com/watch?v=bzcgAshAg2o

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-074

Levitating CD 2.80

Fix some coins with tape to a CD as it can be seen in the figure. Use so many coins that the already CD sinks. If you let a given amount of water flow into the middle of the CD it doesn't sink. Explain and investigate this phenomenon!

Figures:

Origins:

National High School Physics Competition Measurment Problem in 2015 (no explanation was needed)

https://www.komal.hu/verseny/feladat.cgi?a=honap&h=201510&t=fiz&l=hu (figure in the page)

own observation

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-079

Maxwell Wheel 2.80

Build suspended wheels which continuously winds and unwinds up and down a string. Investigate the parameters affecting this motion.

Figures:

Origins:

http://www.youtube.com/watch?v=8Ch9TDeW1FU

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-086

Newtons Bucket Telescope 2.80

Construct a telescope that uses surface of liquid as a mirror. (You can use Newton's Bucket effect to produce near perfect parabola). Discuss quality of measurements possible with such device.

Is it possible to obtain photograph of Andromeda in which you can see that it's not a single star?

Figures:

https://en.wikipedia.org/wiki/Liquid_mirror_telescope

Origins:

Multiple experiments in IYPT involved rotating discs. Sometimes we placed water container on it and peculiar reflections appeared on the ceiling. Obtaining a good quality mirror this way is definitely possible the main problem is with brightness of the reflection. Using opaque fluid should solve the problem to some extent. That technique of making a telescope allows for change in focal length of the mirror making focusing with mirror geometry interesting possibility.

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Proposition for problem 1. or Problem 17.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-021

Can't Hold 2.73

A can't hold toy, also known as water wigglie or water snake, consists of a tube-shaped plastic bag that can fold onto itself, filled with water . When you squeeze the toy, it often slips out of your hand. Investigate the conditions under which this happens.

Figures:

Origins:

I encountered a commercial version of the toy in an acquarium gift shop. There are many other version available on the web:
https://www.youtube.com/watch?v=VcNWgBwCfh8
http://ru.aliexpress.com/item/Can-t-Hold-Water-Snake-Large-Funny-Wacky-Toys-Creative-Tricky-Toy-Props-4-Colors/625664548.html?spm=2114.10010208.0.44.vaCofk&isOrigTitle=true
https://www.amazon.com/American-Science-Surplus-5016-Wigglies/dp/B00000IUZU
https://www.amazon.com/Water-Snake-Wigglies-inch-Colors/dp/B004USMJSY/ref=pd_sim_21_1?ie=UTF8&dpID=41xeQZmJotL&dpSrc=sims&preST=_AC_UL160_SR160%2C160_&psc=1&refRID=1RGSQEQENQ08Z1HGK4E5

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

The slipping effect is incredibly robust and avident to anyone who can get their hands on the toy. There is an interesting interplay of friction and hydrodynamics.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-034

Dance of the Wedding Rings 2.73

Investigate the motion of a spinning ring starts its motion with a kinematics similar to disks, i.e., moving along a cycloidal path prograde with the direction of its rigid body rotation.

Figures:

Origins:

2015 American Physical Society

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: Merge with ID 2017-023 "Dance of the Wedding Rings" and ID 2017-024 "Dance of the Wedding Rings"
2017/03/24 IM: Apparently, we should also merge with ID 2015-106 "rotating ring"

ID 2018-076b (2018-138)

Wooden Drawings 2.73

If you put electrodes with hight voltage on wooden board. You can observe drawings like lighting on the table. Explore this phenomenom and find relevant parameters.

Figures:

Origins:

https://en.wikipedia.org/wiki/Lichtenberg_figure

Novelty:

I am not sure whether a similar problem has been at the IYPT in the past

Comments:

Feasibility:

I trust literature or information from my colleagues that the problem is apparently feasible at the IYPT level

Discussion:

2017/03/23 IM: ID 2018-076 "Lichtenberg Woodcuts" and ID 2018-138 "Wooden Drawings" should be merged.

ID 2018-084

Moiré Pattern 2.73

If you take two pieces of lightweight fabric with regular geometric patterns and overlay one upon the other, you will see several types of patterns. Explain this phenomenon and investigate how relevant parametres affect to type of pattern.

Figures:

Origins:

https://www.youtube.com/watch?v=cvWF_Q5-Kt8
https://www.youtube.com/watch?v=90O12ESQWRc

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-052

Floppy Paper 2.67

Cut a 2:1 rectangle from a sheet of paper. Cut it in two squares and put them one on top of the other. Hold them by the edge. Sometimes they bend together and sometimes the lower one tends to bend more resulting in a characteristic V shape. What properties of the paper are responsible for this effect? Can you use it to measure said properties?

Figures:

https://www.youtube.com/watch?v=63ILZ9cZ2d4

Origins:

Own observation on regular and toilet paper reminded by the video attached.
Youtube video with a qualitative explanation
https://www.youtube.com/watch?v=63ILZ9cZ2d4

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Anisotropy of the regular paper in most cases is neglected in previous IYPT investigations. This effect has surprisingly high magnitude and can be easily presented in live presentation. Numerous factors (humidity, type of paper - some traditional methods produce homotripic sheets, size of the sheet etc.) influencing the effect make the investigation worthwhile. Possibility of measurement makes the investigation systematic.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-057

Grazing Rays Optics 2.67

If we are to design an imaging optical system focusing high-energy radiation the use of refraction and (close to) normal reflection does not seem to be viable.

Construct a simple optical system which would focus visible light by glancing it off reflective surfaces. Try to assure that the grazing angle would not be greater than 10°. Investigate relevant parameters of your system like angular resolution, field of view, fraction of the incoming light which gets concentrated, etc.

Figures:

Origins:

Some ~15 years ago I read about astrophysicists who suggested a new design for a hardware inspired by crustaceans' eyes. This was quite a fine example showing how nonsensical the bureaucratic compartmentalisation of the Science into branches is and I kept it in my mind.

There are actually several types of designs which had been discussed (and some of them realized in well-publicised scientific projects). I do not want to give any preferences to some of them at the expence of the others.

References:

Wolter, H. (1952). Annalen der Physik. 10: 94. doi:10.1002/andp.19524450108

Angel, J. (1979) Astrophysical Journal, Part 1, vol. 233, p. 364-373

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Quite deliberately, the formulation of the problem suggests construction of a "simple" device and does not require optimization of its parameters.

Teams should not be encouraged to spend too much time, efforts and amounts of money on technological challenges like precision manufacturing and alignment.

I think that construction of a demonstration model should be within reach of the teams but I have no lab around to do such a trial. If experts think that the limitation of the grazing angle to 10° is too tolerant, I'd agree to a smaller value, as well.

I dare say that such a problem can enrich students' understanding of optics and to acquaint them with some recent developments in astrophysics.

Feasibility:

I trust literature or information from my colleagues that the problem is apparently feasible at the IYPT level

Discussion:

ID 2018-073

Lazy Fluid 2.67

Suppose a hose is partially filled with fluid to one end. While emptying, the whole train of fluid will leave the hose at the same time. If however one empties a fluid from a hose with a column of air originally at the outflowing end, the part of the fluid closest to the air will exit the hose first before the subsequent parts start to move. Describe the different flow patterns and investigate the parameters that cause them.

Figures:

Origins:

personal observation

Novelty:

I am not sure whether a similar problem has been at the IYPT in the past

Comments:

Feasibility:

I am not sure how feasible is the problem from the IYPT perspective

Discussion:

ID 2018-076a **(2018-076)**

Lichtenberg Woodcuts 2.67

When high voltage is applied between two points on a wooden board, intricate patters are formed. Explain and investigate the resulting pattern and the dependence on relevant parameters.

Figures:

Image found via google search, http://waynesthisandthat.com/images/licht%20992.jpg

Origins:

[1] L. Niemeyer, et al. "Fractal Dimension of Dielectric Breakdown", Phys. Rev. Lett. 52(12), 1984
[2] Y. Takahashi, "Two Hundred Years of Lichtenberg Figures", J. of Electrostatics 6, 1979
[3] Video Example 1; https://youtu.be/AOtgPZE2lkI
[4] Video Example 2; https://youtu.be/BuG1oNRQnyI

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

The phenomena is a form of dielectric breakdown. It would be interesting to see what parameters the students will choose to quantify; breakdown voltage, the time taken for the two growing breakdowns to meet as a function of distance, the Hausdorf dimension of the resulting figures, width length growth of the main current line as a function of time, influence of voltage on the time and patters, etc.

Feasibility:

I trust literature or information from my colleagues that the problem is apparently feasible at the IYPT level

Discussion:

2017/03/23 IM: ID 2018-076 "Lichtenberg Woodcuts" and ID 2018-138 "Wooden Drawings" should be merged.
2017/04/15 JB: I think this should be rejected due to the potential use of lethal power sources.

ID 2018-104

Separating Inks 2.67

Using a disk, motor and simple supplementary material, construct a device for separation mixture of inks (or food dyes, watercolors). Determine the number of species. Investigate sensitivity of your method.

Figures:

Origins:

Ling X. Kong [et. al.]. Lab-on-a-CD: A Fully Integrated Molecular Diagnostic System. J Lab Autom. 2016 Jun;21(3):323-55. doi: 10.1177/2211068215588456

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well), I trust literature or information from my colleagues that the problem is apparently feasible at the IYPT level

Discussion:

ID 2018-046

Eggs & Milk 2.60

If a hard-boiled egg spinning on a tabletop passes through a pool of milk split onto the table, milk is drawn up the sides of the egg and sprays off the equator. Explain the phenomenon and investigate other shapes.

Figures:

Origins:

http://scitation.aip.org/content/aip/journal/pof2/27/3/10.1063/1.4913574

https://www.youtube.com/watch?v=s5XVqWA1mj4

Novelty:

There was a similar IYPT problem in the past, but I endorse the new proposal as interesting and important

Comments:

This is similar to 1999 Question 1 Rotation, however the investigation of other geometries provides new depth to the question.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-078

Magnetic Parcels for Breakfast 2.60

Take cereal parcels that you eat for breakfast and put one on a water surface. If it bring quite strong magnet, parcel will move. Explain and investigate this phenomenon.

Figures:

Origins:

https://youtu.be/9DPs2_LgPgI?t=171

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: Merge with ID 2017-093 "The ship moving with the help of magnets"

ID 2018-100

Seeing Through Metal 2.60

A sheet of common aluminium foil can go translucent if heated with a gas torch or otherwise. Investigate this effect.

Figures:

Origins:

Reported to us by a colleague. Youtube videos and other sources were checked to make sure that the effect indeed exists. Own experiments not carried out yet.
https://www.youtube.com/watch?v=bRPgRMy2AvA
https://www.liveleak.com/view?i=4fb_1249021770

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

The exact explanation of this effect does not seem to be well-established, making the problem interesting for students. Presenting and debating the proofs of a correct explanation will be motivating at Physics Fights. At the same time, it would seem as if the effect is reachable even if the foil is heated in cooking oven (see youtube video). A potential drawback of this problem is that students would have to discuss some chemistry, especially if the eventual core reason is synthesis of sapphire, i.e. one form of aluminium oxide (note: at this point, this is just a colleague's hypothesis).

Feasibility:

I trust literature or information from my colleagues that the problem is apparently feasible at the IYPT level

Discussion:

2017/04/15 JB: We would certainly need to determine whether this effect can be reproduced or not.

ID 2018-119

Tap Air Bubble 2.60

When you open a tap water faucet and water starts flowing out, sometimes you can see a stable air bubble suspended in the stream near the faucet. Under what conditions does this bubble appear and becomes stable?

Figures:

Origins:

Multiple own observations. Apparently this is a common effect with many different types of faucets. The bubble is fairly stable, i.e. it doesn't break spontaneously, but can be broken with a hand. A few demo videos:
https://www.youtube.com/watch?v=x8IegVHSt4I
https://www.youtube.com/watch?v=QgtE3PdHYjE

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-023

Casting Hose! 2.53

A rubber hose is "cast" using a bicycle wheel and a metal ball bearing. Can we set the features of the parabola according to the the angular velocity of wheel bike?

Figures:

http://iypt.ro/docs/

Subiectul 3 IYPT 2017 RO.pdf

http://iypt.ro/docs/Subiectul%203%20%20IYPT%202017%20RO.pdf

Origins:

Experimentarium, Timisoara, RO

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Generally in school is studying the oblique throwing a pointlike body (stone, rarely projectile). Considering this issue its actually throwing a body with continuously distributed mass . The experimental device is not dangerous and can be easily made.
The Theory of motion of bodies with weight evenly distributed may raise serious theoretical and based approach that can lead to heated discussions

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-042

Droplet Non-Coalescence Phenomenon 2.53

In an aquarium, two electrodes are submerged in a lower (A) and higher (B) fluids, which do not mix. Under certain conditions, a droplet of fluid A, coming from the top of the aquarium and passing through the fluid B, will bounce of the surface of the fluid A and will start going upwards. Investigate the effect and determine what are the boundary conditions for the manifestation of the effect.

Figures:

Origins:

W. D. Ristenpart, J. C. Bird, A. Belmonte, F. Dollar, H. A. Stone: Non-coalescence of oppositely charged drops. Nature 461, 377-380 (2009)

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

The only point I would like to emphasise is that for this experiment, a high voltage source is needed. Otherwise, everything else is feasible, even with the standard camera with 60 fps.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well), I trust literature or information from my colleagues that the problem is apparently feasible at the IYPT level

Discussion:

2017/04/15 JB: How high is the voltage? I think this problem needs some clarification.

ID 2018-045

Egg White Pearls 2.53

Insert uncooked egg white into a syringe and eject from a needle-point with lateral motion into a warm oil bath of approximately 70°C. The egg white cooks and condenses so that when the oil is passed through a sieve, the egg white appears pearl-like. Explain the phenomena and investigate how properties of the egg white pearls such as the stiffness or size distribution depend on relevant parameters.

Figures:

http://msihua.com/wp-content/uploads/2011/08/Quay_kingfish.jpg

Origins:

[1] P. Gilmore, "Fragrant poached chicken, white radish, sea scallop, smoked eggplant cream, pea blossoms recipe", served at the Quay Restaurant in Sydney, Australia

A problem of personal curiosity. While taste and atmosphere are important qualities of a good restaurant, one of the most important of all is the 'consistency' of the product. As such, I was curious not just for the size but also the distribution that it will take.

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Had this been a simple non-viscous or even Newtonian fluid the size could probably be traced down to the Rayleigh-Plateau instability. However, for this particular case the polymeric nature of egg white is likely to complicate this explanation. Also, volume and stiffness change as the egg white cooks is also an important consideration.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-070a **(2018-070)**

iPhone 2.53

When a laser is incident on a smartphone a diffraction pattern can be seen in the reflection. Investigate how the pattern depends upon the relevant parameters.

Figures:

Origins:

Idea in "Education Matters" in Australia. Idea from teachers fora practical using student phones.

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Allows possibility of determining pixel size of smartphone.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: ID 2018-070 "iPhone" and ID 2018-109 "Smart Phone Screen" should be merged.

ID 2018-117

Supercooled Water 2.53

It is known, that the distilled water will not freeze even at 0 degrees Celsius without any external vibrations. However, any shaking of a bottle make it freeze before the eyes. Investigate which relevant parameters affect on the speed of freezing of supercooled water?

Figures:

Origins:

https://en.wikipedia.org/wiki/Supercooling
https://www.youtube.com/watch?v=p0QcgfLqlBA

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/24 IM: Merge with ID 2016-134 "Water Hysteresis"

ID 2018-071

Kinder Surprise 2.47

Place a plastic Kinder Surprise shell at the open end of a horizontal tube closed at the other end. If you blow onto the shell, it will fly out of the tube. Explain and investigate this phenomenon.

Figures:

Origins:

This phenomenon is known enough.

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

This phenomenon is very simple to observe, but its explanation conceals some pitfalls. Is it a Bernoulli effect? What is the cause of the phenomenon — decrease in pressure before the shell or increase in pressure inside the tube?

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-080

Mechanical-Electrical Analogies 2.47

Mechanical-electrical analogies are widely used to explain electrical phenomena in familiar mechanical terms or vice-versa. Construct an electric circuit and its analogous mechanical apparatus and investigate the susceptibility of both of them to the variation of relevant parameters.

Figures:

Origins:

http://lpsa.swarthmore.edu/Analogs/ElectricalMechanicalAnalogs.html

Novelty:

I am not sure whether a similar problem has been at the IYPT in the past

Comments:

Feasibility:

I trust literature or information from my colleagues that the problem is apparently feasible at the IYPT level

Discussion:

ID 2018-039

Dried Paper 2.40

A sheet of dried wet paper always showed wrinkle With apparently weakened strength. Investigate this phenomena.

Figures:

Origins:

After a wet sheet of paper is dried, it usually expands and generate long wavelength wrinkles. As a result, mechanical strength of this dried paper is usually weakened. Furthermore, changing the drying process may alter the degree of weakening.

Drying and flattening paper
(http://www.conservation-wiki.com/wiki/Drying_and_Flattening_Paper)
Drying a book (https://theepicenter.com/blog/drying-wet-books-papers/)

Novelty:

I am not sure whether a similar problem has been at the IYPT in the past

Comments:

The modern paper is not only composed by fiber but with lots of

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: Merge with ID 2015-152 "Wavy When Wet" and ID 2016-089 "Paper wrinkles".

ID 2018-041

Dripping Faucet 2.40

When a faucet is dripping, in some circumstances, chaotic behavior can be observed. Investigate this phenomenon.

Figures:

Origins:

Coullet, P., L. Mahadevan, and C. S. Riera. "Hydrodynamical models for the chaotic dripping faucet." Journal of Fluid Mechanics 526 (2005): 1-17.

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-091

Perpetuum Mobile 2.40

Despite the fact that we have always been said that it is impossible to create a perpetual motion machine, attempts to invent it do not leave many scientists. Create your own "pseudoeternal" engine and achieve the maximum operating time. What are the phenomena cause the highest increase in the working hours?

Figures:

Origins:

https://www.youtube.com/watch?v=fQQ8_PDAdfI
http://libarch.nmu.org.ua/handle/GenofondUA/78397

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-107

Shower Curtain 2.40

In a shower with a shower curtain it is observed that the curtain bends inwards when the shower is used. Explain and investigate the phenomenon as a function of relevant parameters.

Figures:

Origins:

Personal observation.

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Students could vary position of shower head, water temperature, hang masses on the bottom of the curtain, simulate the air flow, explain in terms of pressure and temperature differences, fluid flow, vortices. They could build a model system with well controlled variables, or use their own/school showers.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: Merge with ID 2015-117 "Shower-curtain Effect".

ID 2018-118

Tablecloth Pull 2.40

Magicians often show a trick called "tablecloth pull". A table is covered with a tablecloth, on top of which are some dishes, and under certain circumstances it is possible to remove the tablecloth by pulling it while the dishes stay on top of the table. Investigate the parameters which have influence on the phenomenon.

Figures:

Origins:

https://van.physics.illinois.edu/demos/Tablecloth%20And%20Dishes/tablecloth_and_dishes.php
http://iopscience.iop.org/article/10.1088/0031-9120/50/3/324/meta
http://search.proquest.com/openview/312af50af29990c689d81e1337e8d2f5/1?pq-origsite=gscholar&cbl=40590

Novelty:

I am not sure whether a similar problem has been at the IYPT in the past

Comments:

Feasibility:

I trust literature or information from my colleagues that the problem is apparently feasible at the IYPT level

Discussion:

2017/03/24 IM: Merge with ID 2015-134 "Tearing down the Tablecloth"

ID 2018-008

And Yet It Moves 2.33

Suggest, describe and test experimental methods to prove the rotation of Earth.

Figures:

Origins:

Galileo Galilei. (2017, February 7). In Wikipedia, The Free Encyclopedia. Retrieved 19:53, February 17, 2017, from https://en.wikipedia.org/w/index.php?title=Galileo_Galilei&oldid=764168890
Earth. (2017, February 16). In Wikipedia, The Free Encyclopedia. Retrieved 19:54, February 17, 2017, from https://en.wikipedia.org/w/index.php?title=Earth&oldid=765793437
Earth's rotation. (2017, February 10). In Wikipedia, The Free Encyclopedia. Retrieved 19:54, February 17, 2017, from https://en.wikipedia.org/w/index.php?title=Earth%27s_rotation&oldid=764669257

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: This is a nice topic, but I would consider rejecting the problem now. As per the IYPT regulations, in place from day one, our problems are "complicated". What if a problem would ask to prove that "the Earth has a gravitational field" or that "the Moon shines because its surface reflects light from the Sun"? One would come up with various methods, but I don't feel this is an IYPT problem.

ID 2018-072

Knotted Vortices 2.33

Circular vortex rings are often seen in the form of smoke rings, mushroom clouds, etc. However, it is very difficult to produce one or more vortex rings as a knot. Propose a method to produce knotted vortex rings and investigate the resulting dynamics in relation to relevant parameters.

Figures:

http://irvinelab.uchicago.edu/images/research-vortex.jpg

Origins:

[1] D. Kleckner and W. Irvine, "Creation and Dynamics of Knotted Vortices", Nature Phys. 9, 2013
[2] D. Kleckner, et al. "The life of a vortex knot", Phys. Fluids 26, 2014
[3] F. Maggioni, et al. "Vortex knots dynamics in Euler Fluids", Procedia IUTAM 7, 2013
[4] F. Maggioni, et al. "Velocity, energy, and helicity of vortex knots and unknots", Phys. Rev. E 82, 2010
[5] X. Liu and R. Ricca, "Tacking Fluid structures complexity by the Jones polynomial", Procedia IUTAM 7, 2013
[6] R. Ricca, Structural complexity of vortex Flows by diagram analysis and knot polynomials, How Nature Works, Springer International Publishing, 2014
[7] https://youtu.be/YCA0VIExVhg
[8] https://youtu.be/rcnw8NeJqjU

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Vortex rings have been featured in past IYPT problems, most recently the 'half-ring' vortex of Frisbee Vortices ('16). And while knotted vortex rings have been theoretically considered and considered stable in Eulerian flow, recent efforts to produce the rings have shown that they quickly destabilize. It seemed considering how real systems differ from Eulerian ones would be an interesting topic. Observation of the dynamics, topological changes, predictions on the time required for the rings to fully destabilize seem like a reasonable solution to the problem.

Feasibility:

I trust literature or information from my colleagues that the problem is apparently feasible at the IYPT level

Discussion:

ID 2018-077

Loud Belt 2.33

Bending a long belt by half and holds its both ends. First push closer both ends to form a mouth shape then pull the both ends quickly. A loud sound will generate when the belt hit together. What are the relevant parameters affecting the sound generated?

Figures:

Origins:

When pulling a pieces of belt, leather or cloth, loud sound will be generated. This is a quite general phenomena and played by children. The sound tone and level will be changed by the pulling power.

This is a little bit related to the problem "wet towels" in 2010, but different in sound generation mechanism.
Can't find related information in the internet, though I know there should be somewhere.

Novelty:

I am not sure whether a similar problem has been at the IYPT in the past

Comments:

The belt is not necessary leather, cloth belt can also generate sound with different properties. I believe there can be other kind of belt for study. Since the sound quality is changed by pulling, there should be quite a lot thing for investigation.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-082

Mesmerizing Cocktail 2.33

Pour cream over dark colored alcohol in a flat container. If you do it slowly characteristic pattern occurs. Explain the phenomenon. Can you use it to measure alcohol content of the dark fluid? Estimate precision of such measurement.

Figures:

Origins:

Self observations while making cocktails.

Observe on youtube:
https://www.youtube.com/watch?v=x2yAPjFHG-Y

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/04/15 JB: Use of alcoholic drinks - reject?

ID 2018-085

Mpemba Effect 2.33

In some condition may hot water freezer faster than cold water. Explore this phenomenom and say causes of this effect

Figures:

Origins:

https://en.wikipedia.org/wiki/Mpemba_effect

Novelty:

I am not sure whether a similar problem has been at the IYPT in the past

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: Merge with ID 2015-089 "Mpemba Effect", ID 2015-090 "Mysterious freezing", ID 2013-02 "Freezing hot water", and ID 2016-132 "Warm and cold". In 2015, we discussed whether we should reject ID 2016-132 based on the fact that all previous versions were not ranked high in the vote. We kept it, and it was not ranked high again. My suggestion is to reject ID 2018-085 now.
2017/04/14 SB: Given the history of the problem I also suggest to reject it.
2017/04/15 JB: Maybe one day it will be accepted? Could this be the year?

ID 2018-128

Tsunami 2.33

This type waves is a big problem for seismic areas in the world. Investigate formation, travelling and destroying this waves. Make device, which we can use like breakwater.

Figures:

Origins:

https://en.wikipedia.org/wiki/Tsunami

Novelty:

I am not sure whether a similar problem has been at the IYPT in the past

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well), I trust literature or information from my colleagues that the problem is apparently feasible at the IYPT level

Discussion:

2017/04/14 SB: Feasible?
2017/04/14 IM: Well... the students can build a model ocean shore on the scale 1:100 or perform various numerical simulations. I don't find it very promising.
2017/04/15 JB: I'm not keen either but modelling should be feasible.

ID 2018-129

Violin Music! 2.33

When a body is sliding on a support will hear a sound due to friction between the two bodies. Try to establish a connection between the coefficient of sliding friction and sound.

Figures:

Origins:

The first time we talked about this phenomenon and the possibility of being measured was at WFPhC , Indonesia, Bandun 2016

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Japan IPHO team tried to get such a relationship between sliding friction sound and friction coefficient. The results were not convincing, so they gave up of using the idea. For IYPT would be a problem with open solution.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-130

Volleyball 2.33

Describe trajectory of volleyball ball after serving like function of relevant parameters

Figures:

Origins:

https://en.wikipedia.org/wiki/Volleyball

Novelty:

I am not sure whether a similar problem has been at the IYPT in the past

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/04/14 SB: One type of serve in volleyball is without spin. The ball will still follow an interesting path because of small asymmetries. With a more refined wording the problem could be interesting.

ID 2018-003

A Lensless Microscope 2.27

With just a web-camera/smartphone camera and a lamp (no necessary white light lamp), construct a lensless microscope and investigate the characteristics. You can construct your additional sample holder to allow easier handling of the samples. Compare your images with the images from an optical microscope.

Figures:

Origins:

http://makezine.com/projects/make-14/lensless-microscope/

A. Ozcan, E. McLeod, Lensless Imaging and Sensing. The Annual Review of Biomedical Engineering (2016) 18:77–102 (http://innovate.ee.ucla.edu/wp-content/uploads/2016/01/annurev-bioeng-092515-010849.pdf)

http://thesis.library.caltech.edu/8095/1/Thesis_final_SALee.pdf

S. A. Leea, C. Yanga, A smartphone-based chip-scale microscope using ambient illumination. Lab on a Chip (2014) 14, 3056-3063

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

(Or another option would be without the condition that the microscope has to be lensless.)

Feasibility:

I trust literature or information from my colleagues that the problem is apparently feasible at the IYPT level

Discussion:

ID 2018-006

Aluminum Brake 2.27

Neodymium magnet falls near the aluminium plate. Describe how the dynamics of a magnet depends on the plate width.

Figures:

Origins:

Novelty:

Comments:

Feasibility:

Discussion:

2017/03/24 IM: Merge with ID 2016-130 "Viscous Copper"

ID 2018-120

Tea Mug Hovercraft 2.27

Physicists like drinking tea, but sometimes spillages due to overfilling the mug happen. This can cause a low friction state, the mug start sliding and may fell off even from a nearly horizontal table. Study and explain the phenomenon.

Figures:

Origins:

The origin of the problem is my own observation, when I make some tea. One time, the mug almost fell off from my approximately horizontal table because of the same reason. After that, I made some preliminary experiments and the same phenomena happened all the time: for a given time, the mug was sliding on the table with a very low friction.

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: Merge with ID 2017-026 "Dancing Cup"

ID 2018-123

The Flame That Always Goes Up! 2.20

If we apply a continue voltage of moderate value (i.e.12V) between two conductors, uninsulated and sufficiently close, among them appears an electric flame. The flame go permanently up between the two wires, whether we lean or overturn the circuit! Explain the phenomenon according to relevant parameters !

Figures:

http://iypt.ro/docs/

Subiectul 2 IYPT 2017 RO.pdf

http://iypt.ro/docs/Subiectul%202%20%20IYPT%202017%20RO.pdf

Origins:

Experimentarium, Timisoara, RO

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

It is one of the few issues feasibile that connects thermodynamics with electricity.
Gas ionization is not a subject that is too often made experimentally with accessible devices

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/04/14 SB: I have my doubts that the wires are directly connected to 12 V DC (see photo).
2017/04/15 JB: I agree with Samuel. I have only ever done this with high voltage and potentially deadly power supplies,

ID 2018-126

Thread Monorail 2.20

Fix the thread under some angle. Place your device which can move along the thread with a baloon. Investigate how the efficacy of a device depends on the size of a baloon. For which of the part of such monorail the efficacy reaches maximum? Determine the dependence of carrying capacity on the relevant parameters.

Figures:

Origins:

Novelty:

Comments:

Feasibility:

Discussion:

ID 2018-087

Non-Newtonian Liquid 2.13

Moving your hand from air into water "slowly" will feel little resistant force; the opposite occurs when moving the hand at a high speed. This effect can become much more dramatic when adding flour (e.g. tapioca starch) into the water. Investigate this effect (e.g. moving speed vs resistant force) and its relevant parameters.

Figures:

Origins:

personal observation

Novelty:

I am not sure whether a similar problem has been at the IYPT in the past

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/04/15 JB: Repeat of ‘Hard Starch’ (2005) - reject?

ID 2018-105

Severed heads 2.13

One can observe an interesting fenomena occuring with severed heads of matches in water. If you place mathes' heads into plastic bottle of water and press the bottle, heads go down. If you release pressure, heads go up. Investigate the phenomena. Can the same effect be observed in other liquid e.g. sparkling water, organic solvents (acetone, ethyl alcohol), milk? Can other materials except of mathes' heads perform in the same way in water?

Figures:

Origins:

Youtube Video channel "Slivki show" (in Russian)
Here's the link
https://youtu.be/_9yOLKiT_RQ?t=2m23s
and here
http://www.youtube.com/watch?v=qq68r7L6iL8

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

actually we did try the experiments ourselves, however there is enough

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-113

Squeak 2.13

When a soft material (sponge, windshield wiper) rubs against a wet surface, it may produce a squeaky sound. Investigate the origin of this sound, the relevant parameters affecting sound production and suggest how the squeak could be minimized for practical purposes.

Figures:

Origins:

Noticed that even in a luxury Mercedes, windshield wipers squeak

Novelty:

I am not sure whether a similar problem has been at the IYPT in the past

Comments:

The problem has rich physics: friction, wetting, stick-slip motion, acoustic resonance properties of the materials. It is also of industrial relevance as car manufacturers would LOVE having non-squeaky windshield wipers / brakes.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-049

Firing Projectiles 2.07

Construct device, which can fire away projectile for the longest distance only with use mecanical energy

Figures:

Origins:

https://en.wikipedia.org/wiki/Catapult

Novelty:

I am not sure whether a similar problem has been at the IYPT in the past

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/04/15 JB: I think this is far too vague as no projectile or mechanism is specified - reject?

ID 2018-098

Rube Goldberg 2.07

Invent a "Rube Goldberg" machine consisting of a series of energy transfers. The initial energy in the system is to come from a 250g mass raised 1 metre. The efficiency of each energy transfer should be measurable and you are to refine your machine such that the "best" machine is developed where "best" incorporates high efficiency, a large number of energy transfers and many different types of energy transfers.

Figures:

Origins:

No specific source.

Novelty:

I am not sure whether a similar problem has been at the IYPT in the past

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-125

Theremin 2.07

Construct a Theremin instrument where the pitch and volume can be varied via non-contact hand movements. Investigate the parameters which affect the pitch and volume and attempt to create a notation which would allow someone to play a simple tune.

Figures:

Origins:

https://m.youtube.com/watch?v=9STWwl6vivA

Novelty:

I am not sure whether a similar problem has been at the IYPT in the past

Comments:

Feasibility:

I am not sure how feasible is the problem from the IYPT perspective

Discussion:

2017/04/15 JB: A construction exercise (kits on ebay) - not an IYPT problem.

ID 2018-139

Yut Nori 2.07

In a variety of games, random variables are introduced with coins, dice, or in some cases Yut sticks. As the Yut stick is round in one half and flat in the other, the outcome of which side comes front can be somewhat controlled. For example, when rolling the stick on a hard floor, the flat side is more likely to be down. In contrast, when thrown high to fall on a soft surface, as it has the larger surface area, the round side is more likely to be down. By using these biases what are your chances of winning a game of Yut-Nori against a player of random tosses? How does this probability depend on the various parameters such as floor softness?

Figures:

Image was found via a quick google search

https://helloseoul.files.wordpress.com/2010/02/img10f1-tmp1.jpg

Origins:

[1] H. Park, et al. "Analysis of one-dimensional Yut-Nori game: winning strategy and avalanche-size distribution", J. Kor. Phys. Soc. 63(8), 2013

[2] D. Hughes and M. Paczuski, "Large Scale Structures, Symmetry, and Universality in Sandpiles", Phys. Rev. Lett. 88(5), 2002

[3] https://youtu.be/G90o0ai57EM

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

A restated, resubmission of a problem I had previously submitted in the hopes that it will be considered this time. The mechanics, in particular contact mechanics and wood rheology describing the collisions of the sticks and the resulting moves form the bulk of the physical nature of this problem. A quick analysis of the game theory behind the game itself 'can' be interpreted physically, but a simple comparision of the likelyhood of higher numbers, comparing medians to the most common results, etc. can provide interesting statistical elements.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: Merge with ID 2016-145 "Yut" (though it seems to be a submission by the same author, anyway)

ID 2018-059

Headphone Entanglement 2.00

When headphones are stored in a confined space and agitated by walking, the headphones become entangled. Investigate this phenomena, characterize the influence of parameters, and propose methods to reduce the time required to unravel the headphones. In particular, compare round and flat cables and investigate the reason or lack thereof a difference in detangling time.

Figures:

http://www.sciencealert.com/theres-a-scientific-reason-your-iphone-headphones-are-always-tangled

Origins:

D. Raymer and D. Smith, "Spontaneous knotting of an agitated string", PNAS, 104(42), 2007, http://physics.ucsd.edu/~des/DSmithKnotting.pdf

J. Hickford, et al. "Knotting probability of a shaken ball-chain", Phys. Rev. E, 74, 2006, https://people.maths.bris.ac.uk/~majge/hjce.06.pdf

A. Belmonte, et al. "Dynamic Patterns and Self-Knotting of a Driven Hanging Chain"

http://physics.stackexchange.com/questions/184547/why-do-flat-cords-tangle-less-in-my-pocket

http://skeptics.stackexchange.com/questions/7718/are-flat-cables-tangle-free

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

I had seen previous literature on the entanglement of agitated strings as a model for headphone entanglement. However, in these papers, the only relevant parameter is the length and the tendency with respect to the radius, friction, rigidity, agitation (amplitude, frequency, waveform), dimensions of the space of confinement, initial state, etc. were not considered. I wonder if they are truly independent.

Another aspect of the problem that I felt was not fully explored was the detanglement time. The relevant output parameter that we experience is the time it takes to detangle the knoted string and not the crossing number. Even if the crossing number is large, it may be easier to detangle if the radius of the coils are large. As such a conversion to relevant parameters is another step that should be investigated.

A final question is the difference between round and flat cables. One potential reason for

difference could be that the cable tends to bend in only one direction, where as for a round cable, it may bend in all directions. Also, as the cables will try to be parallel to each other due to gravity and the confinement of space, this is likely to have a significant impact upon the dynamics.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: Merge with ID 2017-031 "Entanglement".

ID 2018-037

Don't Bend Up! 1.93

A reed bends under the wind. Investigate how its curvature depends on the wind speed. How do the results change during seasons?

Figures:

Origins:

Novelty:

Comments:

Feasibility:

Discussion:

ID 2018-114

Station Electricity 1.93

If you walk across a Linoleum floor with thick synthetic shoes you will experience a slightly painful electric discharge when you touch a grounded electricaly conducting object like a metal doorknob. Investigate this phenomenon.

Figures:

Origins:

Personal expirience

Novelty:

I am not sure whether a similar problem has been at the IYPT in the past

Comments:

The students can investigate a phenomenon that is familiar with every one concerning electric capacity of the human body and current during the discharge.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-053

Flying Mobile Phone 1.87

Physicists are amazing people. When they walk from one laboratory to another they do love finding wonderful physical phenomena even there, for example, fluctuations in a carried in a hand coffee cup or flight of a mobile telephone that is being thrown up while walking. Investigate how the flight stability depends on the axis of rotation of the phone.

Figures:

Origins:

https://vk.com/videos-19771285?z=video-19771285_456239059%2Fclub19771285%2Fpl_-19771285_-2

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

ID 2018-067

Impossible Water Stream 1.87

Under certain conditions a stream of water may appear frozen in place. Study and explain the phenomenon.

Figures:

https://gfycat.com/DeepCheapKronosaurus

Origins:

http://www.sciencealert.com/the-internet-is-obsessing-over-this-impossible-water-stream

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

I trust literature or information from my colleagues that the problem is apparently feasible at the IYPT level

Discussion:

ID 2018-110

Snow Doughnuts 1.67

Snow Doughnuts

Under certain conditions, hollow cylindrical snowballs, or snow 'doughnuts' are naturally formed. Establish the conditions for which such structures are formed and investigate the physical characteristics of the resulting snowball.

Figures:

https://www.rmets.org/weather-and-climate/image-gallery/looking-through-snow-roller

(not my own image. There are various others which can easily be found using 'snow doughnut' or 'snow roller'.)

Origins:

I was simply browsing the internet when I came across a video of a snow doughnut. I found some qualitative information on the conditions of formation but nothing quantitative, and as such considered it to be an interesting challenge.

https://en.wikipedia.org/wiki/Snow_roller

http://www.npr.org/templates/story/story.php?storyId=8993287
http://www.sciencealert.com/snow-doughnuts
http://blog.nature.org/science/2016/02/10/snow-rollers-rare-meteorological-phenomenon-spontaneous-snowballs-silver-creek-preserve/

C. Browett, Formation of Snow Rollers, Q. J. R. Meteorol. Soc. 34(146), 1908.

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

I think there are two aspects of physical significance. (1) initial actuation via wind, etc. and (2) slight wetness of the inner layer which provides stability. The second aspect which concerns the 'elasticity' or rheology of snow seems very interesting.

However, I do have some doubts on the viability of such research. Snow is not found year round, and may not appear at all for certain countries. Artifical snow and natural snow have drastically different physical properties (especially in their 'clumping' ability, or for the purposes of this problem, the elasticity) and as such may be impossible for experiments that relate well to the natural phenomena.

Feasibility:

I am not sure how feasible is the problem from the IYPT perspective

Discussion:

2017/04/15 JB: Finding snow might be a problem!

ID 2018-081

Medieval Aviation 1.60

Flying was always dream of people. Construct and test device, which is capable of active flight in conditions of european medieval scientists and alchemists

Figures:

Origins:

http://www.da-vinci-inventions.com/flying-machine.aspx

Novelty:

I am not sure whether a similar problem has been at the IYPT in the past

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/04/14 SB: Feasible?
2017/04/14 IM: A helicopter powered by a twister rubber ribbon? A fixed wing glider with a propeller powered by a twisted rubber ribbon? Not particularly promising, but apparently feasible.
2017/04/15 JB: Very vague as no specific mechanism is specified. How do you compare a helicopter and a fixed-wing aircraft?

ID 2018-001

10 000 m

The 10 000 meters run is long-distance athletics competitive distance. Describe behavior of human body during race. Develop procedures or items, which due to improvement personal best. Estimate the best time human possibilities.

Figures:

Origins:

10,000 metres. (2017, January 23). In Wikipedia, The Free Encyclopedia. Retrieved 07:11, January 27, 2017, from https://en.wikipedia.org/w/index.php?title=10,000_metres&oldid=761528589

Anaerobic exercise. (2017, January 13). In Wikipedia, The Free Encyclopedia. Retrieved 07:13, January 27, 2017, from https://en.wikipedia.org/w/index.php?title=Anaerobic_exercise&oldid=759927326

Aerobic exercise. (2017, January 19). In Wikipedia, The Free Encyclopedia. Retrieved 07:13, January 27, 2017, from https://en.wikipedia.org/w/index.php?title=Aerobic_exercise&oldid=760862284

Mo Farah Wins 10,000m Gold - London 2012 Olympics. (2018, August 4). In Youtube. From Olympics .Retrieved 7:13, January 27, 2017, from https://www.youtube.com/watch?v=9-gOCOu_KGU

Novelty:

There was a similar IYPT problem in the past, but I endorse the new proposal as interesting and important

Comments:

Describe biomechanics of long-distance running, metabolism problems etc..

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: This does not look like a physics problem, but rather physiology or biochemistry. There was a similar problem 7. "Runner" (1991), but that one looked more "physical" and had to deal rather with predicting a future value of a complex parameter based on its past values. I don't have a particularly strong feeling about ID 2018-001, but I do believe that it will eventually have no chances, plus is a partial repeat. Therefore I suggest

rejecting it now.
2017/03/23 SB: I agree to reject
2017/05/13 REJECTED (Decision PSC)

ID 2018-005

Acoustic Thermometer

when water is heated in a kettle the bubbles forming are producing a sound. Propose the method to determine water temperature using sound only. Study and optimise precision of this measurement.

Figures:

Origins:

personal observations, everyday experience

Novelty:

There was a similar IYPT problem in the past, but I endorse the new proposal as interesting and important

Comments:

similar problem encountered at 12th iypt (1999) but now rephrased as invent yourself, also discussion of precision is required this time.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: This looks like a repeat of 17. "Sound from water" (1999). The focus goes on determining temperature, rather than simply "investigating and explaining the phenomenon", but I would say this is a repeat and suggest rejecting.
2017/03/24 IM: Should also be merged with ID 2015-138 "The Kettle Sound" (which we also rejected on March 5, 2014 as a repeat of 17. "Sound from water" (1999).
2017/04/14 SB: Based on the former comments I suggest to reject
2017/05/13 REJECTED (Decision PSC)

ID 2018-007

Amalgam

How does depend the melting temperature of Au amalgam on ratio of its constituents?

Figures:

Origins:

Just thought about it is interesting problem.

Novelty:

I am not sure whether a similar problem has been at the IYPT in the past

Comments:

Feasibility:

I am not sure how feasible is the problem from the IYPT perspective

Discussion:

2017/03/23 IM: On one hand, this has certainly been studied in the past, and tabular values must be available. On the other hand, I cannot imagine experiments with reasonable amounts of expensive gold and toxic mercury. I suggest rejecting.
2017/04/14 SB Reject
2017/05/13 REJECTED (Decision PSC)

ID 2018-009

Antigravity Water

Fill a bottle with water and put on its bottleneck a piece of gauze or other fabric. If you turn the bottle over, water won't spill out. Explain and investigate this phenomenon.

Figures:

Origins:

https://www.youtube.com/watch?v=yqJwN3bXQUs

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: ID 2018-009 "Antigravity Water" and ID 2018-055 "Gauze Pourer" should be merged.
2017/03/25 SB: Very similar to 5. Grid (IYPT 2010). I suggest to reject this.
2017/04/14 IM: Yes, good point. I agree and support the idea to reject.
2017/05/13 REJECTED (Decision PSC)

ID 2018-015

Battery Charge

Very often in order to check an alkaline battery power we put it in some devices. However, it turns out that the battery level is reflected in the height of its rebound when it is being thrown. Explore why the charge level affects this height and how accurately it can be determined in such way.

Figures:

https://vk.com/doc136915285_440133781

Origins:

https://www.youtube.com/watch?v=xXQXGjAICIk
https://www.youtube.com/watch?v=PRf9JTg3QwA
http://cyberleninka.ru/article/n/zaryad-kislotnyh-akkumulyatorov
https://www.youtube.com/watch?v=xR1pFbmOw0U

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: Should be merged with ID 2016-010, ID 2016-036, and ID 2017-011. However, since we rejected all of them on March 30, 2015 and on April 5, 2016, it can be meaningful to reject this one too.
2017/05/13 REJECTED (Decision PSC)

ID 2018-020

Bottle Impulse

When a bottle is hit on the top hard enough, the bottle may break. However, the amount of force required to break the bottle is significantly reduced when the bottle is filled with water. Explain the phenomena and investigate how relevant parameters influence the conditions for the bottle breaking.

Figures:

Origins:

[1] J. Daily, et al. "Catastrophic cracking courtesy quiescent cavitation", Phys. Fluids 26, 2014
[2] A. Kiyama, et al. "Effects of a water hammer and cavitation on jet formation in a test tube", J. Fluid Mech. 787, 2016
[3] C. Turangan, "Highly focused microjet simulations using the free-Lagrange method (FLM)", ICMF2013: Proc. 8th Int. Conf. Multiphase Flow; Korea, 232, 2013
[4] M. Cooker and D. Peregrine, "Pressure-impulse theory for liquid impact problems", J. Fluid Mech. 297, 1995

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

It is believed that the impulse results in fast upward acceleration of the fluid and causes a cavity in the fluid body which quickly closes again, causing a massive pressure change in the vacinity of the impact. Quantification of the phenomena, and finding the critical conditions for the bottle breaking seems like an ideal solution.

Feasibility:

I trust literature or information from my colleagues that the problem is apparently feasible at the IYPT level

Discussion:

2017/04/14 SB: Potentially dangerous (glass splitters)
2017/04/15 JB: Yes - potentially interesting but maybe too dangerous - so reject.
2017/05/13 REJECTED (Decision PSC)

ID 2018-024

Celtic Stone

The celtic stone is an asymmetric top, which rotates freely in one direction, but when spun in the other direction it changes its rotational direction after a short rocking motion. Investigate the motion and the relevant parameters influencing this spin-reversal.

Figures:

Origins:

I came across this interesting phenomenon seeing YouTube videos about it.
There are quite a few about it. Here are just a few examples
(you will find most searching for 'rattleback'):
https://www.youtube.com/watch?v=LmEf7aIhpF8
https://www.youtube.com/watch?v=11NHjiEYnI0
https://www.youtube.com/watch?v=69Xm762qE8o
There is also an Wikipedia entry about this topic:
https://en.wikipedia.org/wiki/Rattleback#cite_note-motivate-1
Furthermore there are also some publications about it, mainly focusing on the theoretical aspect of the problem. This are a few
(but more are exisiting):
http://link.springer.com/article/10.1007/s00707-015-1353-z
http://link.springer.com/article/10.3103/S0025654408030023
https://arxiv.org/pdf/1202.6506.pdf
https://www.researchgate.net/publication/260132085_Analysis_of_Rattleback_Chaotic_Oscillations

Novelty:

I am not sure whether a similar problem has been at the IYPT in the past

Comments:

First experiments are very easy, as this special sort of top can be bought for very little money or can be built by the students themselves easily.
The further experimental study of the problem is in its basics quite simple (the inhomogeneous mass distribution, which is the reason for the phenomenon, can be varied easily and other parameters as well). Probably the most difficult part would be the measurement of the rocking motion, but also this should clearly be feasible.
From the theoretical side this problem seems to be quite demanding, but there is quite a lot of useful literature and the level should also be

appropriate for IYPT.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: ID 2018-024 "Celtic Stone" and ID 2018-124 "The Rattleback" should be merged with ID 2015-019 "Celtic stone", ID 2015-104 "Rattleback", and ID 2016-015 "Celtic stone". However, ID 2015-019-104 was rejected at the IOC meeting in Shrewsbury in 2014, and we rejected ID 2016-015 on March 19, 2015. I suggest rejecting straight ahead.
2017/04/15 JB: Yes - this has been rejected many times before.
2017/05/13 REJECTED (Decision PSC)

ID 2018-026

Citrus Numbers

While oranges are spherical, other citrus fruits such as the kumquat or mikan are closer to prolate or oblate ellipsoids. In the case of bubbles or drops, the shape is characterized by dimensionless numbers such as the Eotvos number or Morton number. Investigate the origins of the shape of citrus fruits and define dimensionless numbers which can be used the characterize the various shapes.

Figures:

Origins:

A personal curiosity of mine. In Korea, the mikan is one of the most consumed fruits to an extent that when they are in season, we consume ~10 of those per day. The mikan has a very thin peel, and as such can easily be pealed by hand. In contrast, kumquats or lemons have a much thicker and harder peel and unlike the oblate mikan, they are prolate. I believe that as water is high in density, unless there is a strong peel holding a prolate shape, the fruit would relax due to gravity into an oblate structure. I wondered if the thickness and hardness of the peel and perhaps the water content of the fruits could be used to predict the shape. Perhaps too unconventional of a research problem for students.

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: I don't feel this is an IYPT problem.
2017/04/14 SB: I agree. There is not really much to investigate. Reject?
2017/04/15 JB: Yes - at best an odd problem so reject.
2017/05/13 REJECTED (Decision PSC)

ID 2018-028

Coffee Ring Coupling

When a drop of coffee dries on a smooth surface, a circular stain is formed called a coffee ring. What is the shape of the stain for multiple configurations of droplets such as two placed next to each other or a regular lattice of droplets?

Figures:

Origins:

The coffee ring phenomena in itself is a well known phenomena. It is a result of the convective flows within the droplet as a result of the evaporation. I recently came across a video from the Gallery of Fluid Motion (https://youtu.be/xUi3v_jY8f4) where a droplet placed in between two droplets showed very different convection as a result of the evaporation of the adjacent droplets. I became curious as to how this would result the sedimentation, i.e. coffee ring.

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

General references on the coffee ring phenomena (including problem Liquid Stain '08) along with understanding of the convective flow dependent on adjacent droplets should be useful. When visualizing the flow of evaporated water in air, it may look similar to electrostatic interactions between ++ or --.

Feasibility:

I trust literature or information from my colleagues that the problem is apparently feasible at the IYPT level

Discussion:

2017/04/14 SB: Very similar to “Liquid Stain” (2008, Problem 6). Reject?
2017/04/14 IM: I tend to agree that there is nothing particularly new in this problem. No objections to reject.
2017/04/15 JB: agree - reject
2017/05/13 REJECTED (Decision PSC)

ID 2018-031

Cooling Tube

Vortex or Ranque-Hilsch tubes are produced commercially for cooling applications. Make a working model of such a tube and investigate and explain its operation.

Figures:

Origins:

Initially proposed by me about 10 years ago but not selected.

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: Merge with ID 2014-65 "Ranque-Hilsch vortex tube". Both ID 2014-65 and ID 2018-031 "Cooling Tube" are repeats of 6. "Magic tube" (1997). I suggest rejecting.
2017/04/14 SB: Reject
2017/05/13 REJECTED (Decision PSC)

ID 2018-038

Double Bounce

A double bounce is often mentioned in discussions relating to injuries caused by trampolining. Develop a small scale set up which can be used to investigate the parameters which affect the effects of a double bounce.

Figures:

Origins:

I first came across the term double bounce in a forum discussing trampoline injuries.

Novelty:

I am not sure whether a similar problem has been at the IYPT in the past

Comments:

Double bounce usually refers to one person attempting to transfer energy through the trampoline to a second person, by bouncing, therefore increasing the effect of the second person's bounce.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: I have a feeling that this looks like a topic involving human injuries and not necessarily well-modelled experimentally or theoretically. I would support an idea to reject.
2017/04/15 JB: I would be very unhappy with this problem so reject,
2017/05/13 REJECTED (Decision PSC)

ID 2018-044

Earth Diameter

Suggest method to measure Earth diameter. Test accuaracy of method and compere measuring value with real constant

Figures:

Origins:

https://en.wikipedia.org/wiki/Sauter_mean_diameter

Novelty:

I am not sure whether a similar problem has been at the IYPT in the past

Comments:

Feasibility:

I trust literature or information from my colleagues that the problem is apparently feasible at the IYPT level

Discussion:

2017/03/23 IM: Similar to ID 2018-008, I would consider rejecting the problem now. This is not a thought-provoking "complicated" problem.
2017/04/15 JB: Agree - should be rejected.
2017/05/13 REJECTED (Decision PSC)

ID 2018-048

Feynman Sprinkler

The Feynman sprinkler, or a reversed sprinkled is a device similar to a usual sprinkler, but instead of splashing it sucks the fluid it is submerged to. On the contrary to a standard sprinkler which rotates in direction opposite to the one of splashing the fluid, for reversed sprinkler the situation is not clear. Investigate Feynman sprinkler theoretically and experimentally – were you able to make it rotate?

Figures:

Origins:

General research.

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before, There was a similar IYPT problem in the past, but I endorse the new proposal as interesting and important, I am not sure whether a similar problem has been at the IYPT in the past

Comments:

This experiment is known for more than a century and was made famous by the popular book of Richard Feynman. Still, the answer on the question of whether the sprinkler will rotate and if, into what direction is not clear – scientific papers appear on the topic even now (see e.g. http://aapt.scitation.org/doi/pdf/10.1119/1.4973374). Whereas it is probably hard to expect that high-school students would be able to finally resolve the problem, it believe it is rich enough to allow plenty experiments under different conditions and to some extent theoretical derivation as well.

Feynman sprinkler was mentioned in the Ilya Martchenko kit 2013 in connection to the Helmholtz carousel, but I believe that these two problems are significantly physically different, as the sucking itself in the first order preserves angular momentum conservation, which was not the case in the previous problem.

Feasibility:

I trust literature or information from my colleagues that the problem is apparently feasible at the IYPT level

Discussion:

2017/03/23 IM: An accurate repeat of 8. "Segner's wheel" (1990). I suggest rejecting.
2017/04/14 SB: I agree. Reject.

2017/04/15 JB: Agree - reject.
2017/05/13 REJECTED (Decision PSC)

ID 2018-055

Gauze Pourer

Fill a quarter of bottle with water. Close the bottleneck with the gauze and gently upturn the bottle. Water doesn't flow out. How big can be the gauze cells under which such effect still observable.

Figures:

Origins:

Novelty:

Comments:

Feasibility:

Discussion:

2017/03/23 IM: ID 2018-009 "Antigravity Water" and ID 2018-055 "Gauze Pourer" should be merged.
2017/04/14 SB: Very similar to 5. Grid (IYPT 2010). I suggest to reject this.
2017/04/14 IM: As with 2018-009, I support.
2017/04/15 JB: Agree - reject
2017/05/13 REJECTED (Decision PSC)

ID 2018-056

Global Warming

Global warming is one of the most important problems of civillization. Construct model of atmosphere and simulate this phenomenom. Investigate relevants parameters of changing temperature and suggest solution of problem.

Figures:

Origins:

https://en.wikipedia.org/wiki/Global_warming

Novelty:

I am not sure whether a similar problem has been at the IYPT in the past

Comments:

Feasibility:

I trust literature or information from my colleagues that the problem is apparently feasible at the IYPT level

Discussion:

2017/04/14 SB: In my opinion this problem is far beyond the reach of IYPT. Reject?
2017/04/14 IM: A simple greenhouse can be a model. I don't say that this problem is particularly promising, but I would give it a chance.
2017/04/15 JB: I tend to agree with Samuel - the problem is far too vast and I don't think simple modelling is very informative.
2017/05/13 REJECTED (Decision PSC)

ID 2018-060

Heads and Tails

A common method of making a random choice is tossing a coin. Suggest a device that can land a fair coin on either heads or tails on command and investigate its reliability.

Figures:

Origins:

A colleague of mine can do the trick by counting the number of coin flips in the air and catching it at the right moment. There is also some academic research on the subject:
http://statweb.stanford.edu/~susan/papers/headswithJ.pdf
https://www.youtube.com/watch?v=AYnJv68T3MM

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

The problem is somewhat similar to #1 2016 "Invent Yourself", but is focused on a specific mechanical device. The reasons for the coin toss to be random are actually somewhat nontrivial as shown in the references. The possible constructed devices might launch the coin with a specific initial linear and angular velocity, or count the number of flips.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/04/14 SB: Similar to “Probability” (2006, problem 5). Reject?
2017/04/14 IM: I tend to agree. Reject.
2017/05/13 REJECTED (Decision PSC)

ID 2018-083

Mobile Phone

Accidental drops of mobile phones often result in screen cracks or other visible damages. Investigate how relevant parameters may affect the effectiveness of mobile phone protection cases.

Figures:

Origins:

Very popular theme to students; everyday topic.

http://www.dailymail.co.uk/sciencetech/article-2190668/The-science-shattered-phone-screen-What-causes-crack-others.html

http://androidandme.com/2014/08/opinions/what-you-need-to-know-about-phone-cases-and-drop-protection-warning-science-content/

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: Merge with ID 2017-078 "Smartphone Forensics". As reasoned in 2016, we cannot accept a problem about dropping a phone to crack its screen. Unlike ID 2017-078, this problem allows a possibility to replace the phone with a dummy device, however overall I do not feel that this is a suitable problem.
2017/04/14 SB: I agree that we should not accept “destructive” problems.
2017/04/15 JB: We rejected this previously for the same reason.
2017/05/13 REJECTED (Decision PSC)

ID 2018-090

Paper Dynamometer

Construct the paper-made dynamometer as it is shown in photo. Investigate how its sensitivity depends on the stripe width (it is recommended to vary the width from 0.5 to 3 cm). Analyze the results and maximize the sensitivity of such dynamometer.

Figures:

Origins:

Novelty:

Comments:

Feasibility:

Discussion:

2017/03/23 IM: There is no photo showing this paper dynamometer, and no explanations from the author whatsoever. I suggest rejecting.
2017/04/14 SB: Reject because of missing photo and explanations.
2017/05/13 REJECTED (Decision PSC)

ID 2018-092

Pharaoh's Serpent

When mercury (II) thiocyanate or sodium bicarbonate powder is burned, the resulting reaction produces foam with a intricate branching structure, hence the name, 'Pharaoh's Serpent' or 'Black Snake'. Explain and investigate these intricate patterns and their dependence on relevant parameters, such as the combusting chemical or the flow of oxygen. (Beware. Experiments may be toxic)

Figures:

Origins:

[1] https://youtu.be/vQdK7gaZS0k

[2] https://youtu.be/Hibxz9_ZW18

[3] T. Davis, "Pyrotechnic Snakes", J. Chem. Educ. 17(6), 1940

[4] Wikipedia, "Black snake (firework)"
- https://en.wikipedia.org/wiki/Black_snake_(firework)

Various observations of the phenomena but couldn't find any that describe the physical properties of the resulting structure.

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

There are various aspects of the structure for investigation. In terms of dynamics, the width and growth rate of the structure, the Hausdorff dimension of the structure, etc. The toxic nature of the experiment may make this problem unsuitable.

Feasibility:

I trust literature or information from my colleagues that the problem is apparently feasible at the IYPT level

Discussion:

2017/03/23 IM: I have strong reservations as this is rather a chemical problem, and mercury (II) thiocyanate is no longer commonly used because of its toxicity (ref. https://en.wikipedia.org/wiki/Black_snake_(firework)). I cannot envision particularly unusual physical effects in the growth of this solid foam. I suggest rejecting.
2017/04/14 SB: Reject because of toxic substance.

2017/04/15 JB: I agree - reject for sure.
2017/05/13 REJECTED (Decision PSC)

ID 2018-093

Pole Vault

Pole vault is one of few sports present on the Olympic programme since its first modern edition, in 1896. Investigate how the relevant parameters of the pole may lead to higher jumps.

Figures:

Origins:

https://www.wired.com/2012/08/olympics-physics-pole-vault/

http://entertainment.howstuffworks.com/pole-vault3.htm

Novelty:

There was a similar IYPT problem in the past, but I endorse the new proposal as interesting and important

Comments:

There was a problem softly mentioning pole vaulting in 1992, but this is more specific and can be updated, due to many evolutions in sport science in the last 25 years.

Feasibility:

I trust literature or information from my colleagues that the problem is apparently feasible at the IYPT level

Discussion:

2017/03/23 IM: As the author mentions, this is a repeat of 5. "High jumper" (1992). I don't have a particularly strong opinion on keeping/rejecting, but it does not seem as if the problem will have strong chances.
2017/04/14 SB: I think there are enough new problems to reject a partial copy of an old one.
2017/04/15 JB: My feeling would also be to reject it.
2017/05/13 REJECTED (Decision PSC)

ID 2018-108

Skipping Stones

Throwing a flat stone across a water surface under certain circumstances

the stone might bounce off the surface, even for several times.

What are the optimum conditions to reach the maximum number of bounces?

Figures:

Origins:

Actually this is a nice game probably everyone knows and has tried it himself already. It is a real challenge to find the right stones and to throw them the right way, but actually it is rather trial and error to find the right conditions to get it working well. So I thought it might be quite interesting to investigate this closer in a physical way.
I also found one research paper dealing with the theoretical aspects of the problem:
http://www.phys.ens.fr/~lbocquet/AJPricochets.pdf
And here some further reading is given, which might help as well:
https://www.loc.gov/rr/scitech/mysteries/stoneskip.html

Novelty:

I am not sure whether a similar problem has been at the IYPT in the past

Comments:

There is already some theoretical work about this, but not a lot (I only found one detailed paper about this), which seems to be a quite good basics for own further theoretical contribution.
From the experimental side the students still can do a lot as there is no experimental research so far (at least I could not find any results).
Basic experiments are quite easy and should be feasible for everyone.
Even though elaborate experiments (systematic parameter variation) might be a challenge, but as well feasible on an IYPT level.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: ID 2018-108 "Skipping Stones" and ID 2018-115 "Stone Skipping" are repeats of 8. "Pebble skipping" (2004). Reject.
2017/04/24 SB: Reject

2017/04/15 JB: Yes - reject
2017/05/13 REJECTED (Decision PSC)

ID 2018-111

Space Exploring

Construct a rocket with rocket engine. Investigate relevant parameters and reach maximal height.

Figures:

Origins:

Rocket. (2017, January 18). In Wikipedia, The Free Encyclopedia. Retrieved 17:20, January 26, 2017, from https://en.wikipedia.org/w/index.php?title=Rocket&oldid=760722328

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: I don't feel this is an IYPT problem.
2017/04/14 SB: With the current wording I agree. Reject?
2017/04/15 JB: There are too many reasons not to accept this, including safety.
2017/05/13 REJECTED (Decision PSC)

ID 2018-112

Spiral Waves

Spiral waves and other types of wave patterns may occur on a thin liquid film flowing over a rotating disk. Investigate these wave patterns.

Figures:

Origins:

IYPT

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

I am not sure how feasible is the problem from the IYPT perspective

Discussion:

2017/03/23 IM: A verbatim repeat of 7. "Spiral waves" (2017). Reject.
2017/04/14 SB: Reject
2017/04/15 JB: Yes - reject
2017/05/13 REJECTED (Decision PSC)

ID 2018-115

Stone Skipping

Skipping stones across water has been a popular game. Investigate the parameters that influence the trajectory of the fling. Based on them optimize the distance and number of skips.

Figures:

Origins:

https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.94.174501
https://www.cambridge.org/core/journals/journal-of-fluid-mechanics/article/div-classtitleskipping-stonesdiv/20F788FE0082904112537C46F0CC5A2A
https://www.youtube.com/watch?v=_W8W1XOT-uM

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: ID 2018-108 "Skipping Stones" and ID 2018-115 "Stone Skipping" are repeats of 8. "Pebble skipping" (2004). Reject.
2017/04/14 SB: Reject
2017/04/15 JB: Reject
2017/05/13 REJECTED (Decision PSC)

ID 2018-121

Tears Of Wine

When you swirl wine in a glass and wait for a short while, you can obtain effect known to wine tasters as tears of wine. Determine the factors that influence the characteristic time and length in this phenomenon.

Figures:

Origins:

https://en.wikipedia.org/wiki/Tears_of_wine

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Another hydrodynamical instability problem yet very different than the ones already investigated. There are several contradictory theories about the formation of the effect even though the experiments are extremely easy to reproduce.

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: Merge with ID 2014-85 "Tears" and ID 2014-86 "Tears of Wine"
2017/03/24 IM: Also merge with ID 2016-143 "Wine tears"
2017/04/14 SB: If I remember correctly these problems were rejected because they require the use of alcoholic drinks.
2017/04/14 IM: In 2015, yes. In 2013, they were allowed to vote, but did not get high scores.
2017/04/15 JB: Agree with Samuel - should be rejected due to use of alcohol.
2017/05/13 REJECTED (Decision PSC)

ID 2018-124

The Rattleback

By spinning a Celtic stone, or wobble stone in one direction, it slows down, wobbles, and then starts spinning in the opposite direction! Investigate physics behind this

Figures:

Origins:

http://www.youtube.com/watch?v=CJzRuprW_cc

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: ID 2018-024 "Celtic Stone" and ID 2018-124 "The Rattleback" should be merged with ID 2015-019 "Celtic stone", ID 2015-104 "Rattleback", and ID 2016-015 "Celtic stone". However, ID 2015-019-104 was rejected at the IOC meeting in Shrewsbury in 2014, and we rejected ID 2016-015 on March 19, 2015. I suggest rejecting straight ahead.
2017/04/14 SB: Given the history of this problem I agree we should reject it.
2017/05/13 REJECTED (Decision PSC)

ID 2018-135

Water Sheet

When a small object such as a spoon is placed under a thin stream of water a thin, large water sheet can be formed. Explain the phenomenon and investigate how the properties of the water sheet depend on relevant parameters.

Figures:

https://pixabay.com/de/l%C3%B6ffel-wasser-waschbecken-666287/

Origins:

Personal observation

Novelty:

I have checked archive.iypt.org/problems and confirm that the proposal has never been an IYPT problem before

Comments:

Feasibility:

Experiments are clearly feasible, effects are reachable, no extraordinary equipment needed, I did tests on my own (or feel confident that any experiment will run well)

Discussion:

2017/03/23 IM: A repeat of 10. "Water dome" (1994). I would consider rejecting.
2017/05/13 REJECTED (Decision PSC)