
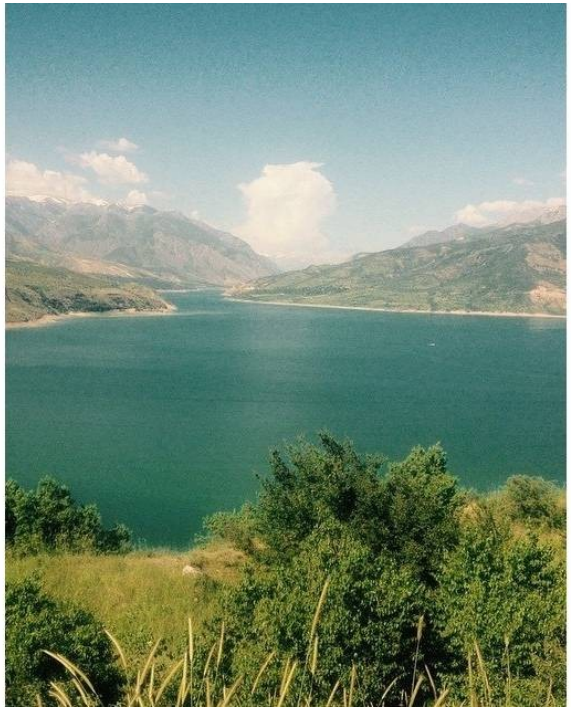


Preparation to the Young Physicists' Tournaments' 2017

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IYPT

PHYSICS WORLD CUP

- Do you like what the IYPT organizers do?
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- Follow @iypt and @iyptarchive on Twitter

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Welcome to the 5th IYNT 2017

Country	2013	2014	2015	2016	Overall
Afghanistan					
Belarus					
Bulgaria					
China					
Croatia					
Georgia					
Iran					
Kazakhstan					
Kyrgyzstan					
Moldova					
Russia					
Serbia					
Turkey					
Ukraine					
Total Teams	16	5	10	16	47
Total Countries	11	4	7	5	14
Total Medals	10	5	6	9	30

- The International Young Naturalists' Tournament, IYNT, is a whole new competition with breathtaking problems, state-of-the-art grading standards, and an impressive momentum
- The IYNT bridges gaps between natural sciences and is focused on participants aged 12 through 16
- The IYNT has so far attracted 47 teams from 14 different countries, has awarded 30 medals, and has given 4098 grades
- Do not hesitate and pre-register today

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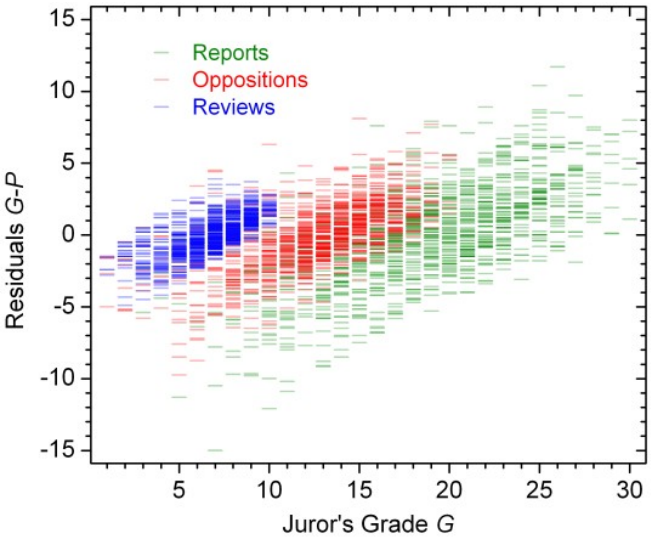


Call for cooperation

- If you are interested in the idea behind the Kit — to structure the existing knowledge about the physics behind the problems and to encourage students to contrast their personal contribution from the existing knowledge — your cooperation is welcome
- If more contributors join the work on the Kit for 2017, or plan bringing together the Kit for 2018, good editions may be completed earlier
- It would be of benefit for everybody,
  - students and team leaders, who would have an early reference (providing a first impetus to the work) and a strong warning that IYPT is all about appropriate, novel research, and not about “re-inventing the wheel”
  - jurors, who would have a brief, informal supporting material, possibly making them more skeptical and objective about the presentations
  - the audience outside the IYPT, who benefits from the structured references in e.g. physics popularization activities and physics teaching
  - the IYPT, as a community and a center of competence, that generates vibrant, state-of-the-art research problems, widely used in other activities and at other events
  - and also the author (-s) of the Kit, who could rapidly acquire a competence for the future activities and have a great learning experience

How to tackle the IYPT problems?

- How to structure a report?
- What level is competitive?
- How to set the goals, fix the priorities, and set the direction of the work?
- How were people resolving particular issues in the past?

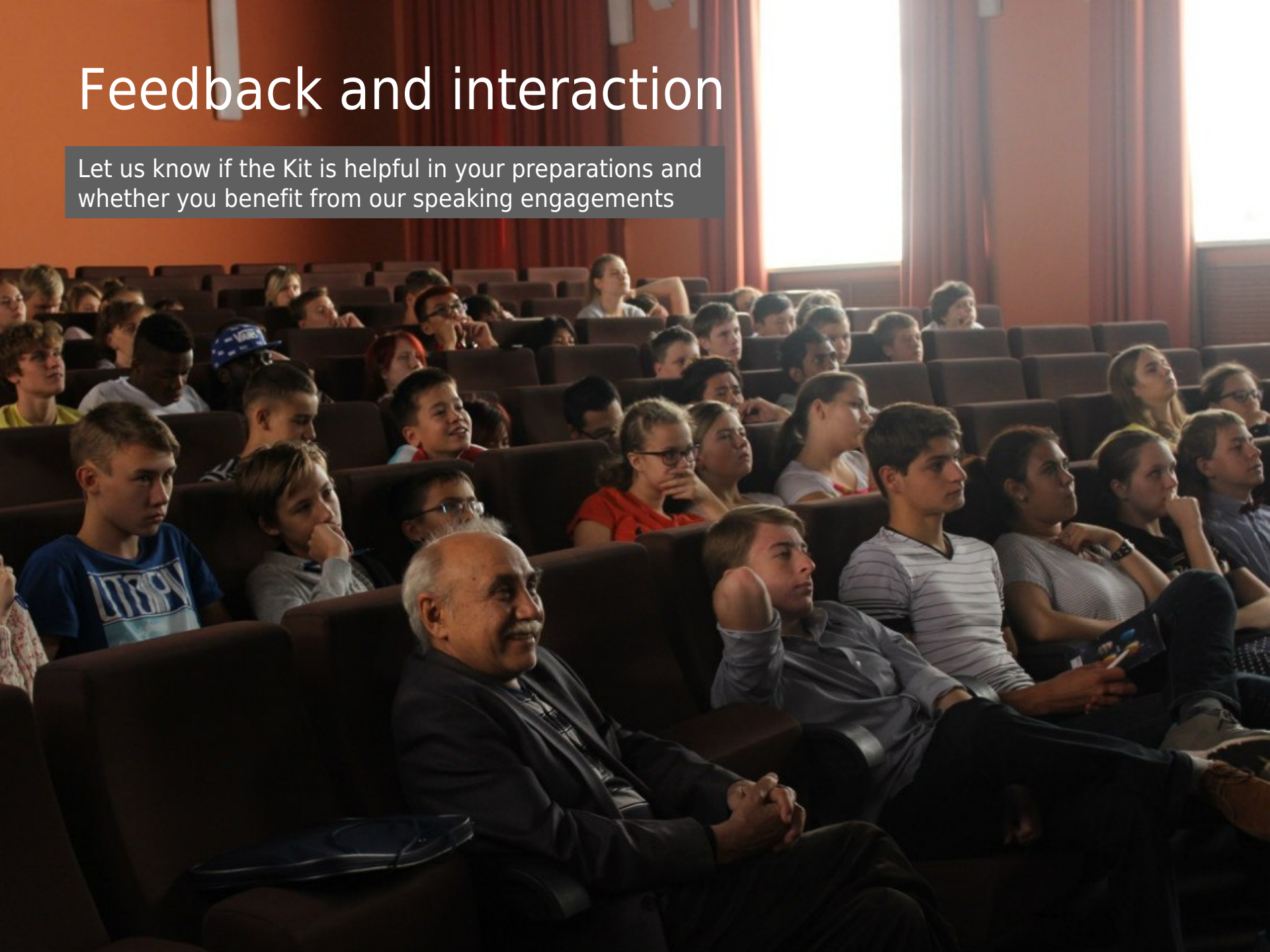
- Look through the historical solutions in the Archive
  - an opportunity for goal-oriented critical learning
  - examples, not guidelines
  - those solutions were good, but yours should be better!

iypt archive mc^2 hv


Is the novel research limited and discouraged by the existing common knowledge and the ongoing work of competing groups? :-)

Feedback and interaction

Let us know if the Kit is helpful in your preparations and whether you benefit from our speaking engagements



Truth is ever to be found in simplicity,
and not in the multiplicity and
confusion of things.

Isaac Newton

// The epigraph for the IYPT 2017 problems approved by the IYPT Founder Evgeny Yunosov

Problem No. 1 “Invent yourself”

Construct a passive device that will provide safe landing for an uncooked hen’s egg when dropped onto a hard surface from a fixed height of 2.5 m. The device must fall together with the egg. What is the smallest size of the device you can achieve?

Background reading

- 1st place Egg Drop project ideas- using SCIENCE (youtube, Mark Robber, May 27, 2015), https://youtu.be/nsnyl8llfH4
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- Egg drop experiment (youtube, Intenseheat, Oct 2, 2012), https://youtu.be/_Xj8jRFYoS8
- Mythbusters ---- Falling egg (youtube, Ruben Kamphuis, Oct 30, 2010), https://youtu.be/ehVQM0I0PSU
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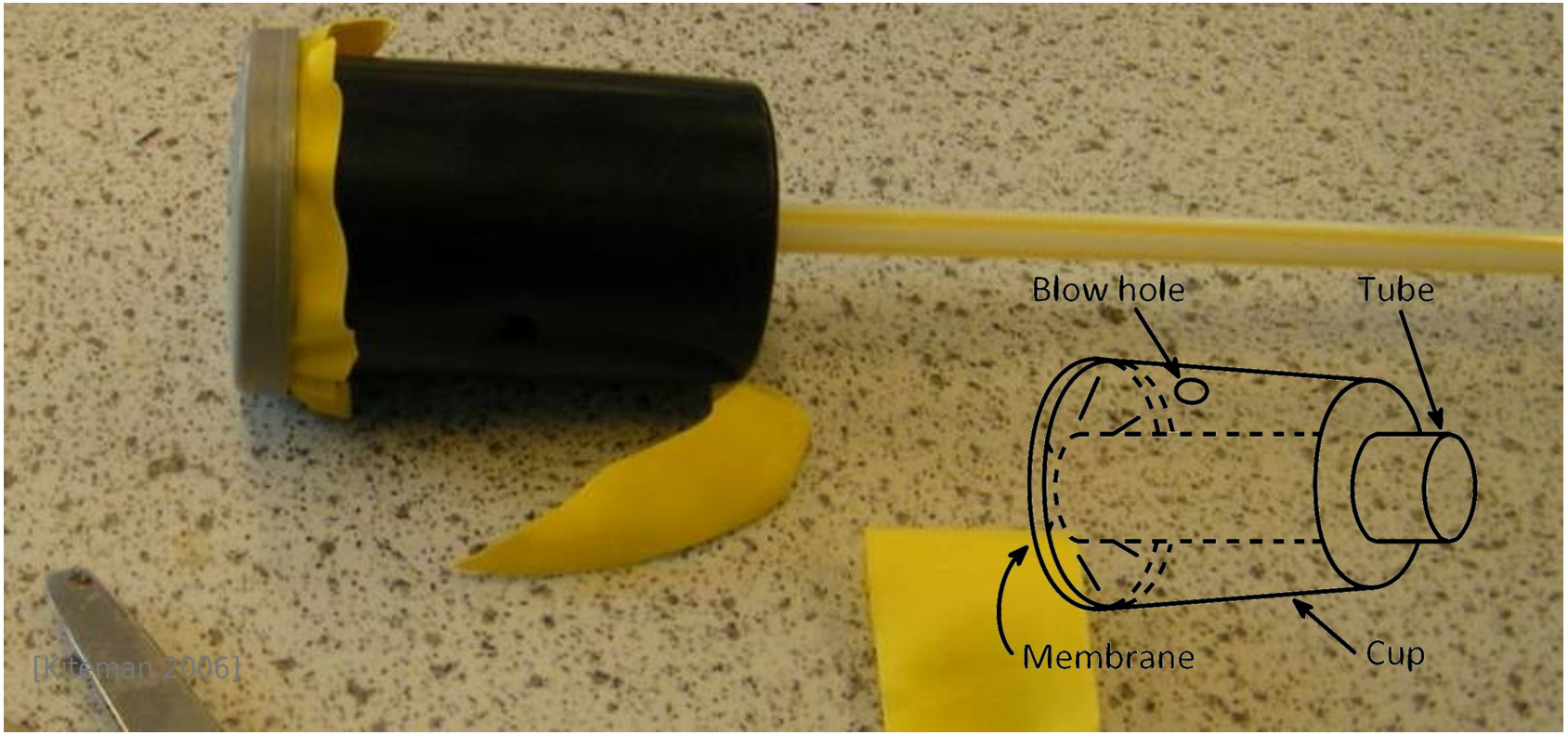

Problem No. 2 “Balloon airhorn”

A simple airhorn can be constructed by stretching a balloon over the opening of a small container or cup with a tube through the other end (see Figure). Blowing through a small hole in the side of the container can produce a sound. Investigate how relevant parameters affect the sound.

Background reading

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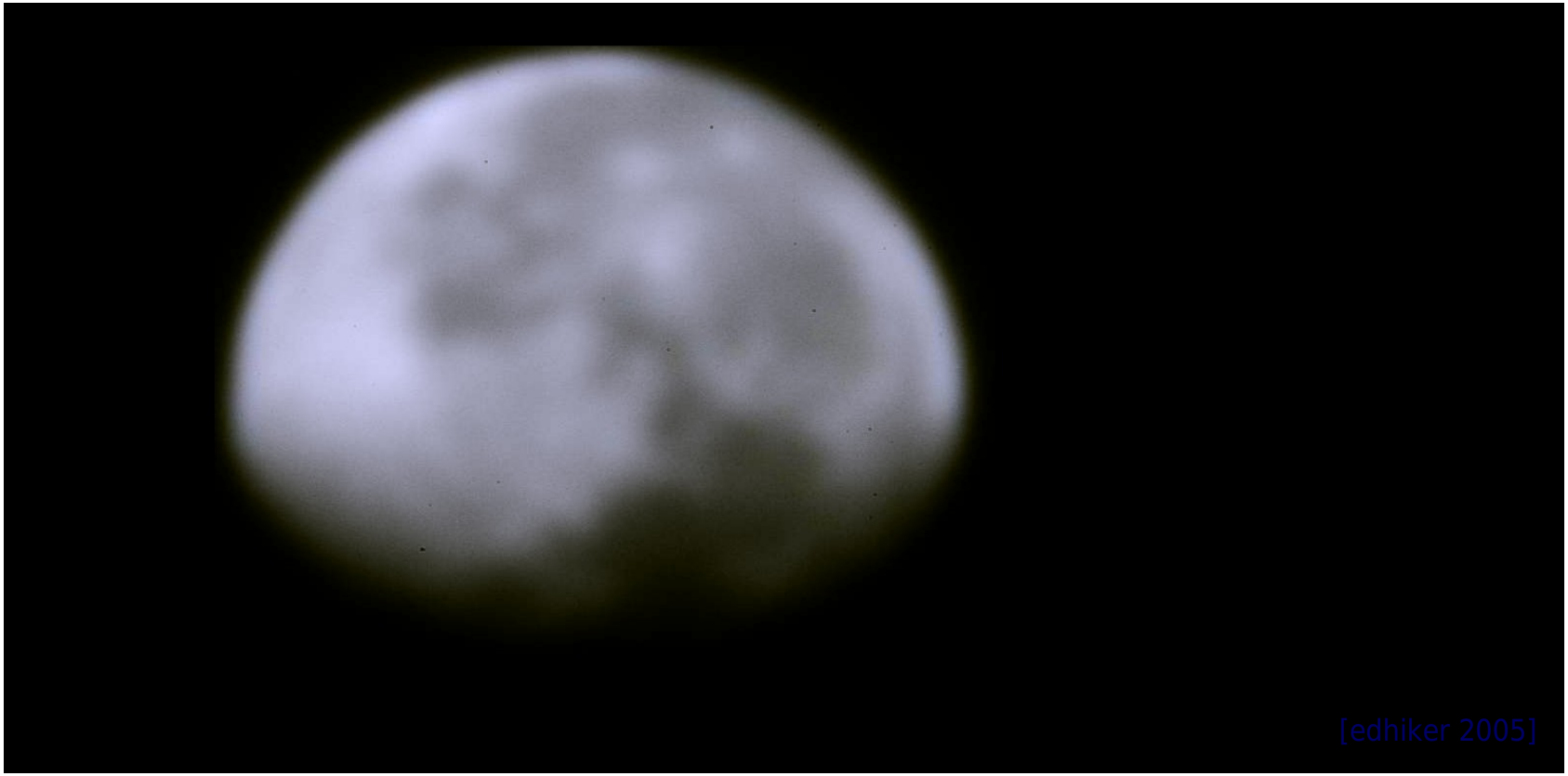

Problem No. 3 “Single lens telescope”

A telescope can be built using a single lens, provided that a small aperture is used instead of an eyepiece. How do the parameters of the lens and the hole influence the image (e.g. magnification, sharpness and brightness)?

Background reading

- How to make a small easy telescope (youtube, epicfanthasy, Dec 5, 2009), https://youtu.be/msIAdyljrwI
- Wikipedia: Refracting telescope, https://en.wikipedia.org/wiki/Refracting_telescope
- Wikipedia: Pinhole camera, https://en.wikipedia.org/wiki/Pinhole_camera
- Telescopes and Optics (Andrew Connolly, Univ. of Pittsburgh), http://www.phyast.pitt.edu/~ajc/teaching/chap6/chap6.pdf
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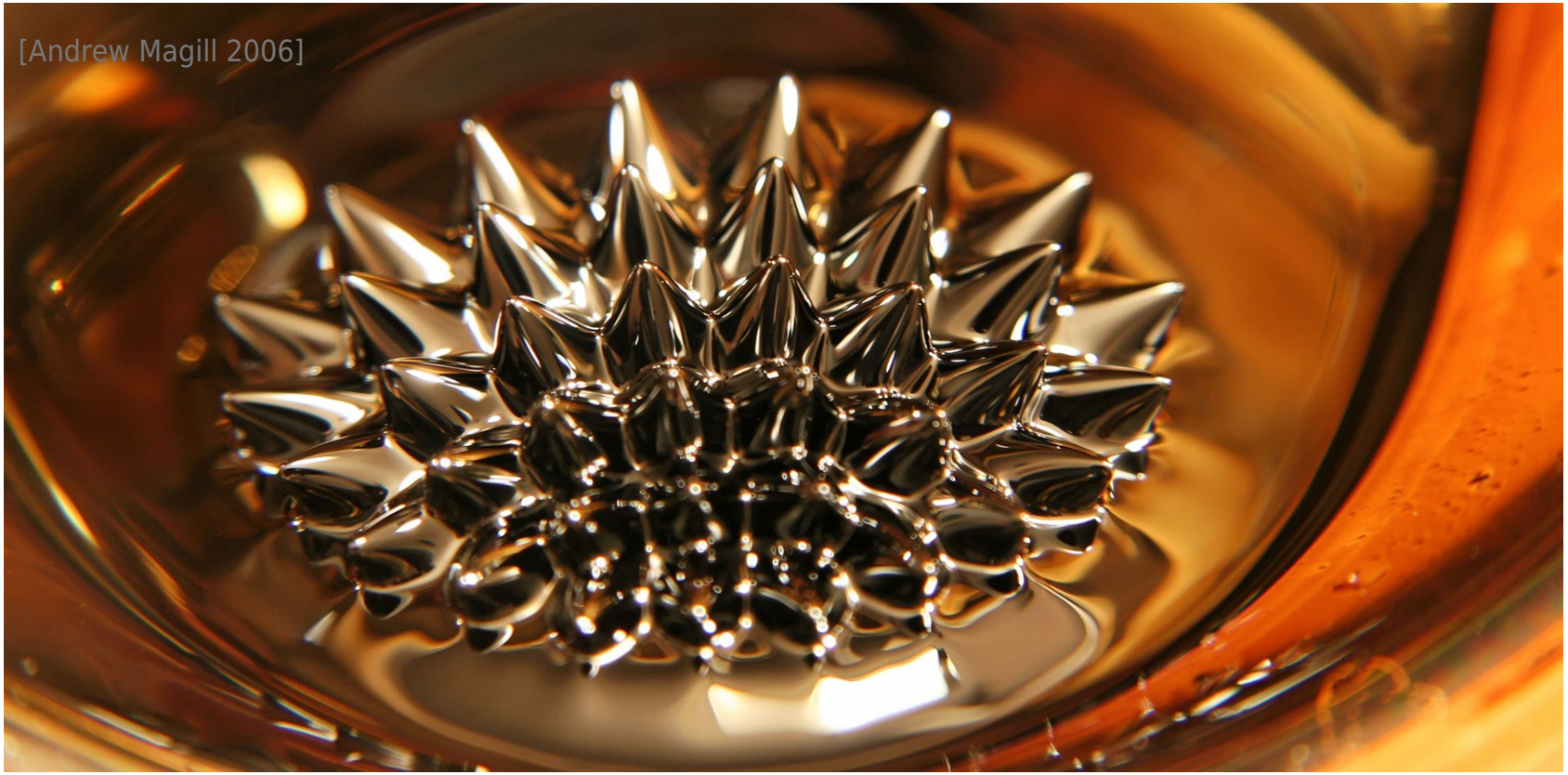

Problem No. 4 “Magnetic hills”

A small amount of a ferrofluid placed in an inhomogeneous magnetic field forms hill-like structures. Investigate how the properties of these structures depend on relevant parameters.

Background reading

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- How to make Magnetic Fluid (ferro fuid) (youtube, HouseholdHacker, Jan 20, 2010), https://youtu.be/vsQh1AT6qUE
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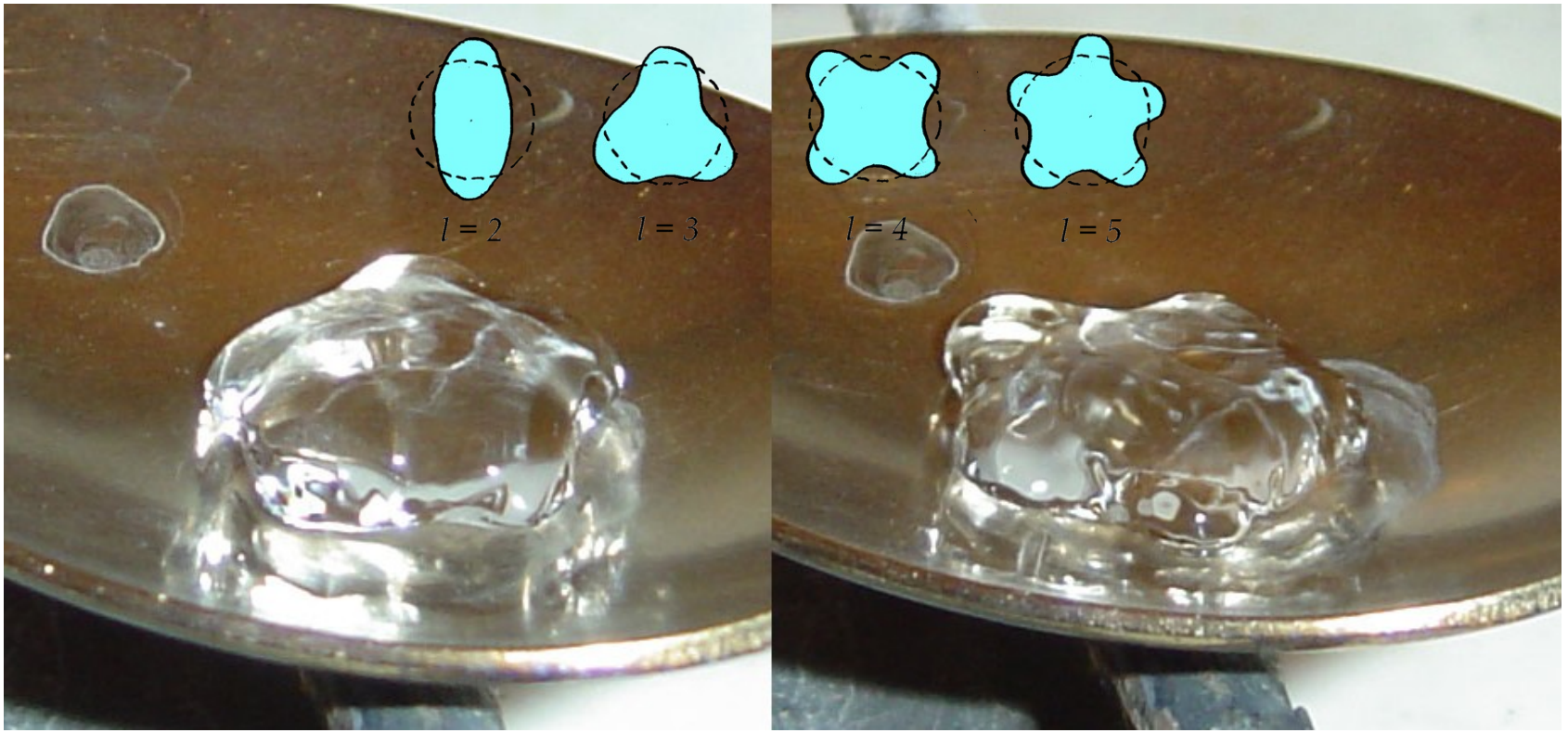

Problem No. 5 “Leidenfrost stars”

In the Leidenfrost effect, a water drop placed on a hot surface can survive for minutes. Under certain circumstances, such a drop develops oscillating star shapes. Induce different oscillatory modes and investigate them.

Background reading

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Problem No. 6 “Fast chain”

A chain consisting of wooden blocks inclined relative to the vertical and connected by two threads (see Figure) is suspended vertically and then released. Compared to free fall, the chain falls faster when it is dropped onto a horizontal surface. Explain this phenomenon and investigate how the relevant parameters affect the motion.

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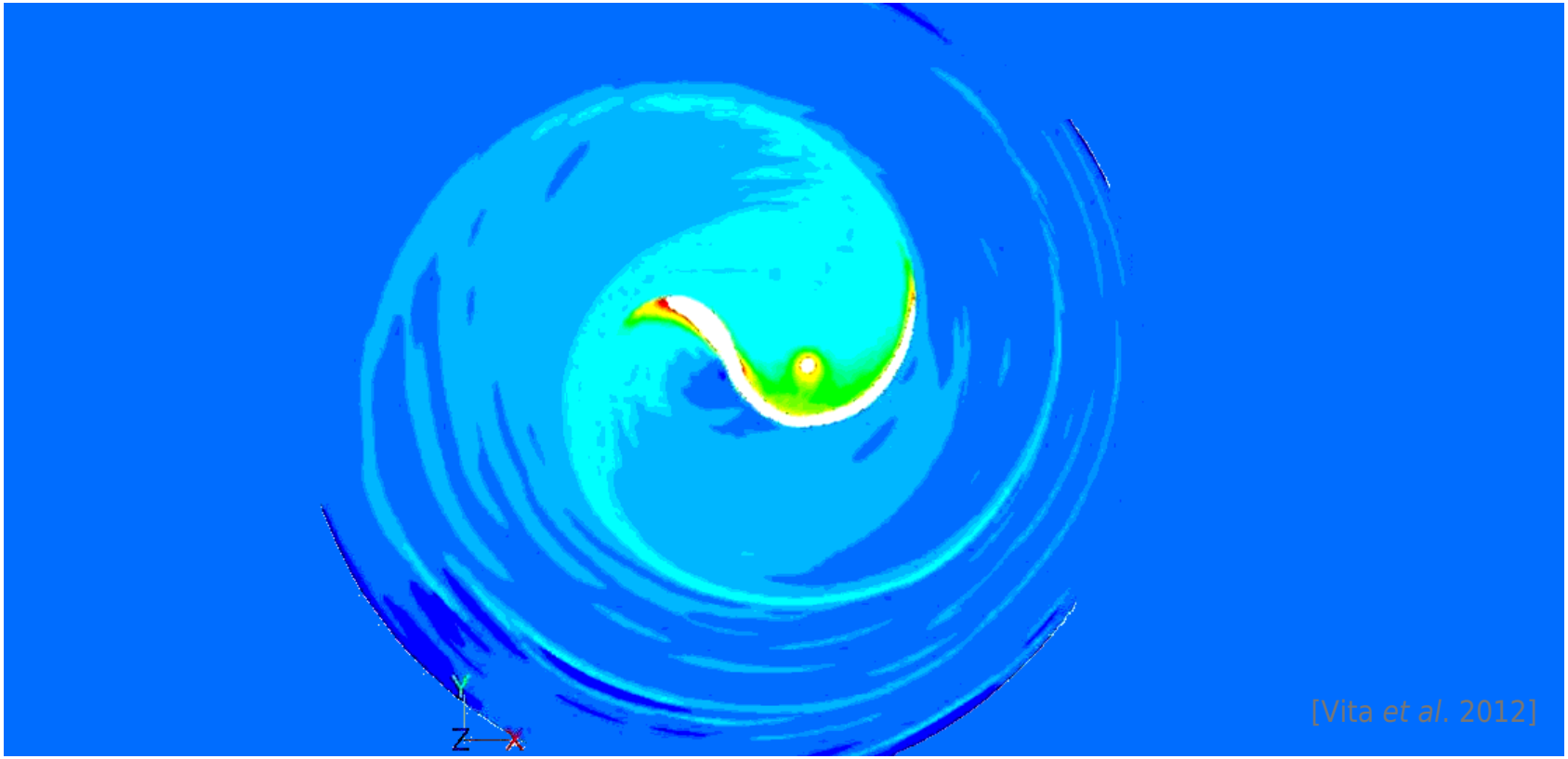

Problem No. 7 “Spiral waves”

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

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Problem No. 8 “Visualising density”

Schlieren Photography is often used to visualise density variations in a gas. Build a Schlieren setup and investigate how well it can resolve density differences.

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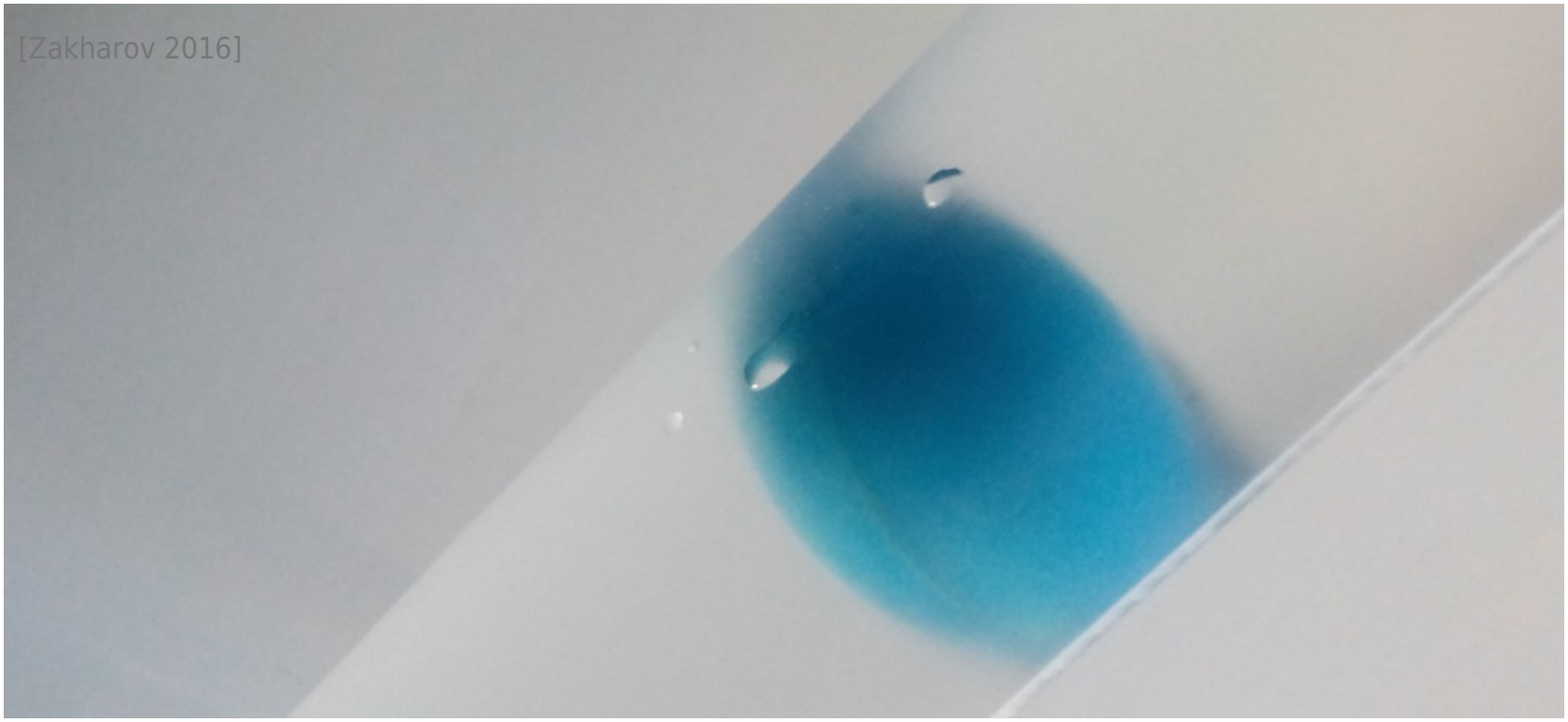

Problem No. 9 “Ball in a tube”

A sealed transparent tube is filled with a liquid and contains a small ball. The tube is inclined and its lower end is attached to a motor such that the tube traces a conical surface. Investigate the motion of the ball as a function of relevant parameters.

Background reading

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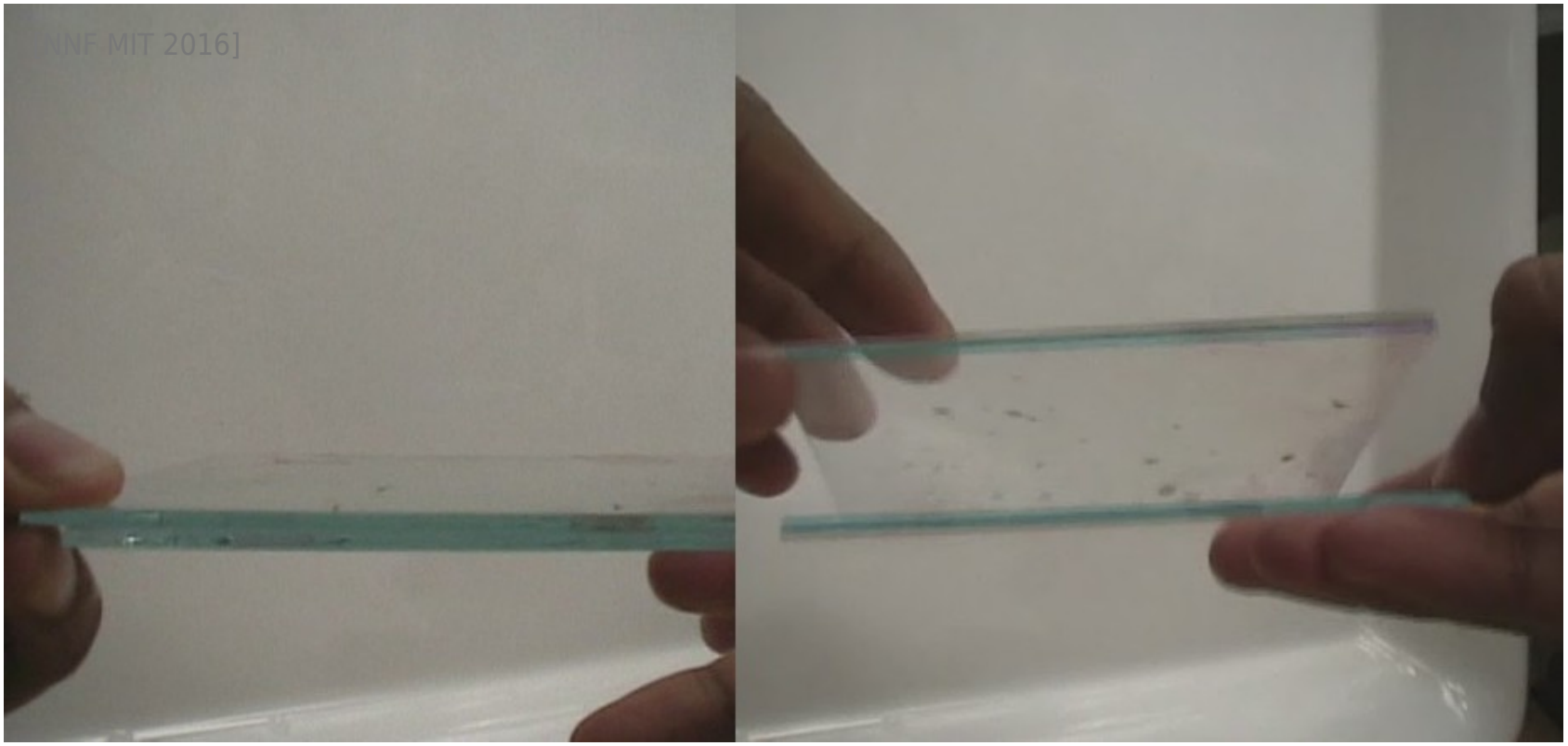

Problem No. 10 “Pulling glasses apart”

Put a thin layer of water between two sheets of glass and try to separate them. Investigate the parameters affecting the required force.

Background reading

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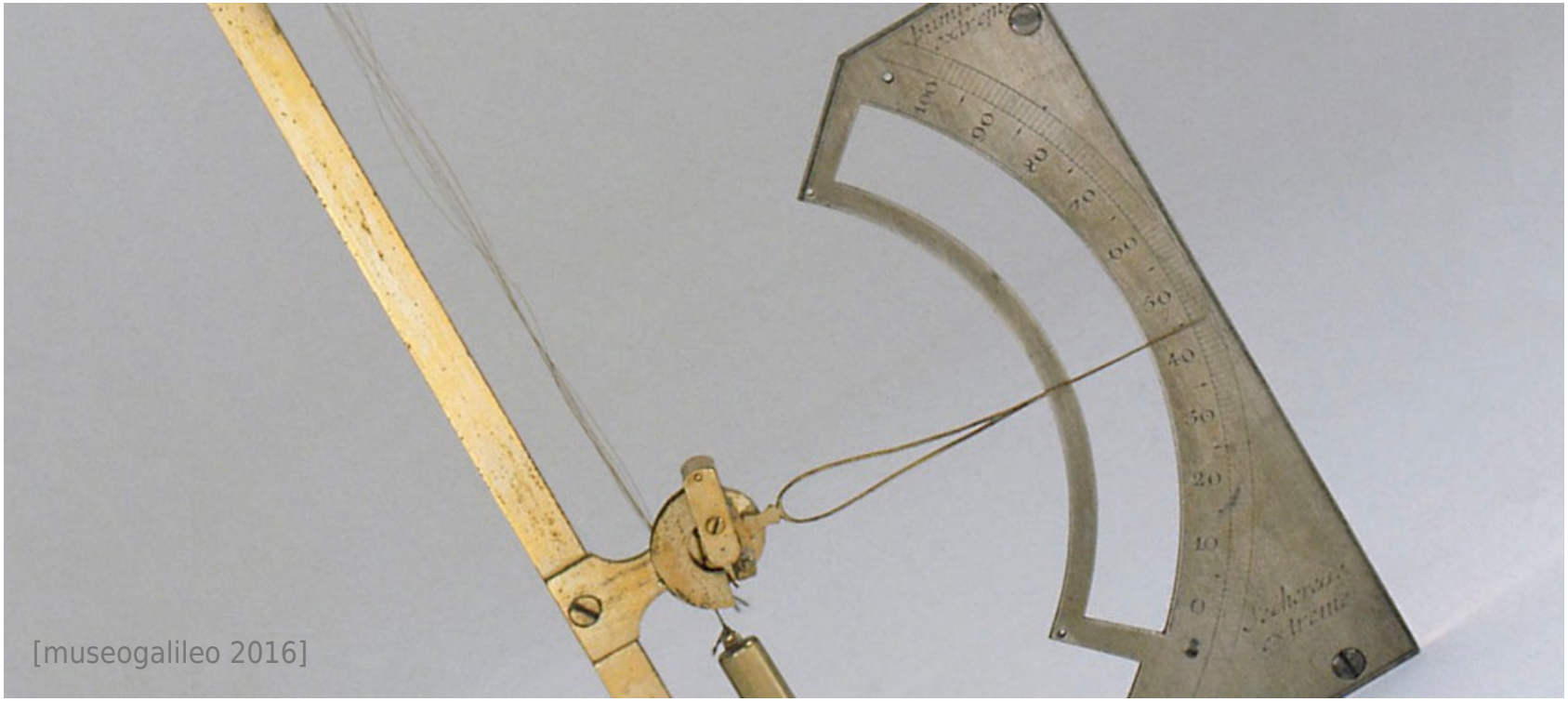

Problem No. 11 “Hair hygrometer”

A simple hygrometer can be built using human hair. Investigate its accuracy and response time as a function of relevant parameters.

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Problem No. 12 “Torsion gyroscope”

Fasten the axis of a wheel to a vertical thread that has a certain torsional resistance (see Figure). Twist the thread, spin the wheel, and release it. Investigate the dynamics of this system.

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Problem No. 13 “Resonating glass”

A wine glass partially filled with liquid will resonate when exposed to the sound from a loudspeaker. Investigate how the phenomenon depends on various parameters.

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Prob. No. 14 “Gee-Haw Whammy Diddle”

A gee-haw whammy diddle is a mechanical toy consisting of a simple wooden stick and a second stick that is made up of a series of notches with a propeller at its end. When the wooden stick is pulled over the notches, the propeller starts to rotate. Explain this phenomenon and investigate the relevant parameters.

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Problem No. 15 “Boiled egg”

Suggest non-invasive methods to detect the degree to which a hen’s egg is cooked by boiling. Investigate the sensitivity of your methods.

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Prob. No. 16 “Metronome synchronization”

A number of mechanical metronomes standing next to each other and set at random initial phases under certain conditions reach synchronous behaviour in a matter of minutes. Investigate the phenomenon.

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Problem No. 17 “Vacuum bazooka”

A ‘vacuum bazooka’ can be built with a simple plastic pipe, a light projectile, and a vacuum cleaner. Build such a device and maximise the muzzle velocity.

Background reading

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- Supersonic Vacuum Cannon (youtube, The Basement Scientist, Apr 6, 2014), https://youtu.be/0DzR3JlmQWo
- How to make a BAZOOKA with a vacuum cleaner (youtube, Roman UrsuHack, Jan 20, 2016), https://youtu.be/4ch4rLyxHgo
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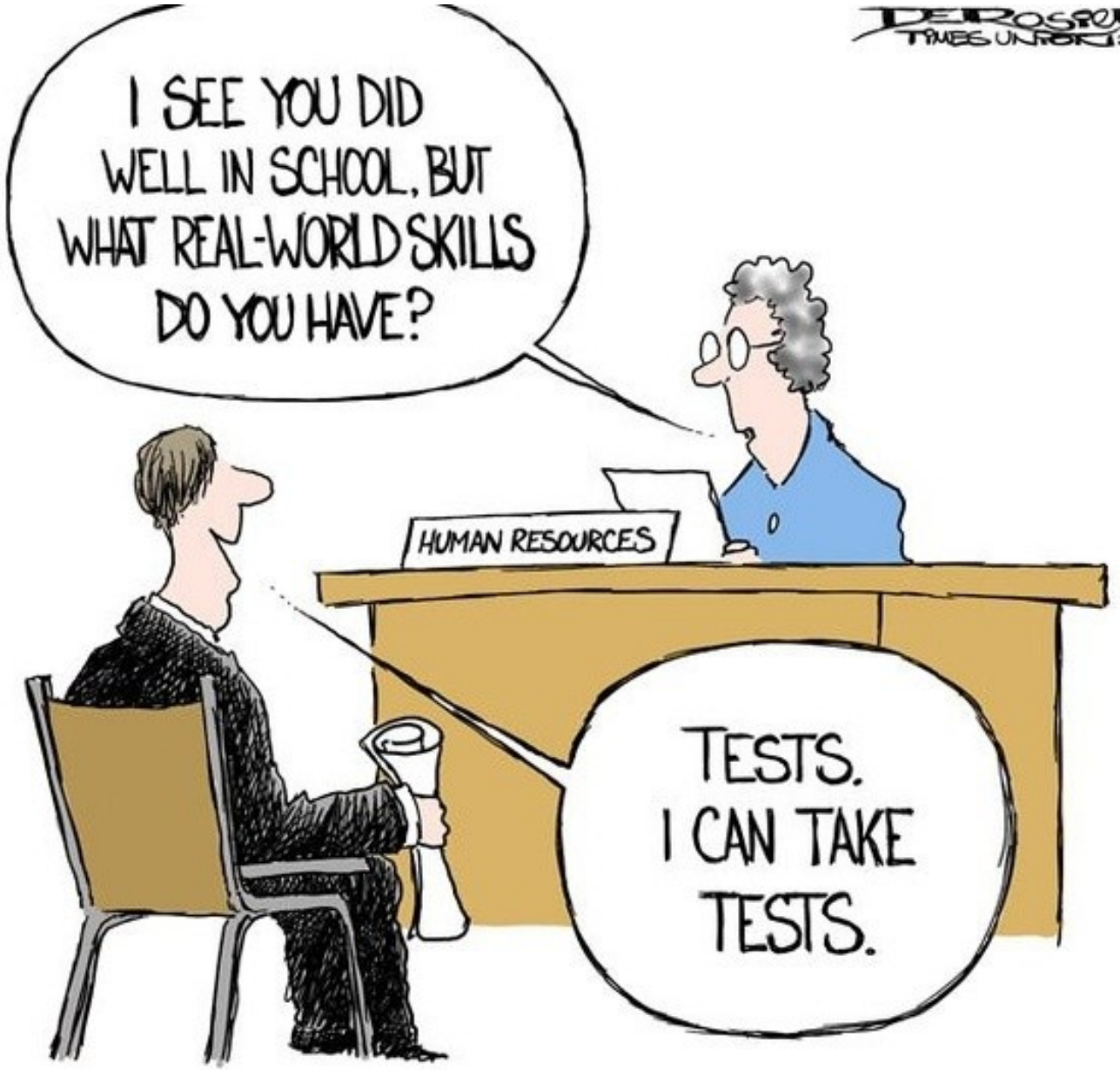
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I SEE YOU DID WELL IN SCHOOL, BUT WHAT REAL-WORLD SKILLS DO YOU HAVE?
HUMAN RESOURCES
TESTS. I CAN TAKE TESTS.

The ultimate response to all "What for?"-questions:

" If we knew what we were doing,
it wouldn't be called research! "

Albert Einstein

Important information

- The basic goal of this Kit is not in providing students with a start-to-finish manual or in limiting their creativity, but in encouraging them to
  - regard their work critically,
  - look deeper,
  - have a better background knowledge,
  - be skeptical in embedding their projects into the standards of professional research,
  - and, as of a first priority, be attentive in not “re-inventing the wheel”
- An early exposure to the culture of scientific citations, and developing a responsible attitude toward making own work truly novel and original, is assumed to be a helpful learning experience in developing necessary standards and attitudes
- Good examples are known when the Kit has been used as a concise supporting material for jurors and the external community; the benefits were in having the common knowledge structured and better visible
- Even if linked from iypt.org, this file is not an official, binding release of the IYPT, and should under no circumstances be considered as a collection of authoritative “musts” or “instructions” for whatever competition
- Serious conclusions will be drawn, up to discontinuing the project in its current form, if systematic misuse of the Kit is detected, such as explicit failure of citing properly, replacing own research with a compilation, or interpreting the Kit itself as a binding “user guide”
- All suggestions, feedback, and criticism about the Kit are warmly appreciated :-)

Habits and customs

- Originality and independence of your work is always considered as of a first priority
- There is no “correct answer” to any of the IYPT problems
- Having a deep background knowledge about earlier work is a must
- Taking ideas without citing is a serious misconduct
- Critically distinguishing between personal contribution and common knowledge is likely to be appreciated
- Reading more in a non-native language may be very helpful
- Local libraries and institutions can always help in getting access to paid articles in journals, books, and databases
- The IYPT is not about reinventing the wheel, or innovating, creating, discovering, and being able to contrast own work with earlier knowledge and the achievements of others?
- Is IYPT all about competing, or about developing professional personal standards?

Requirements for a successful IYPT report

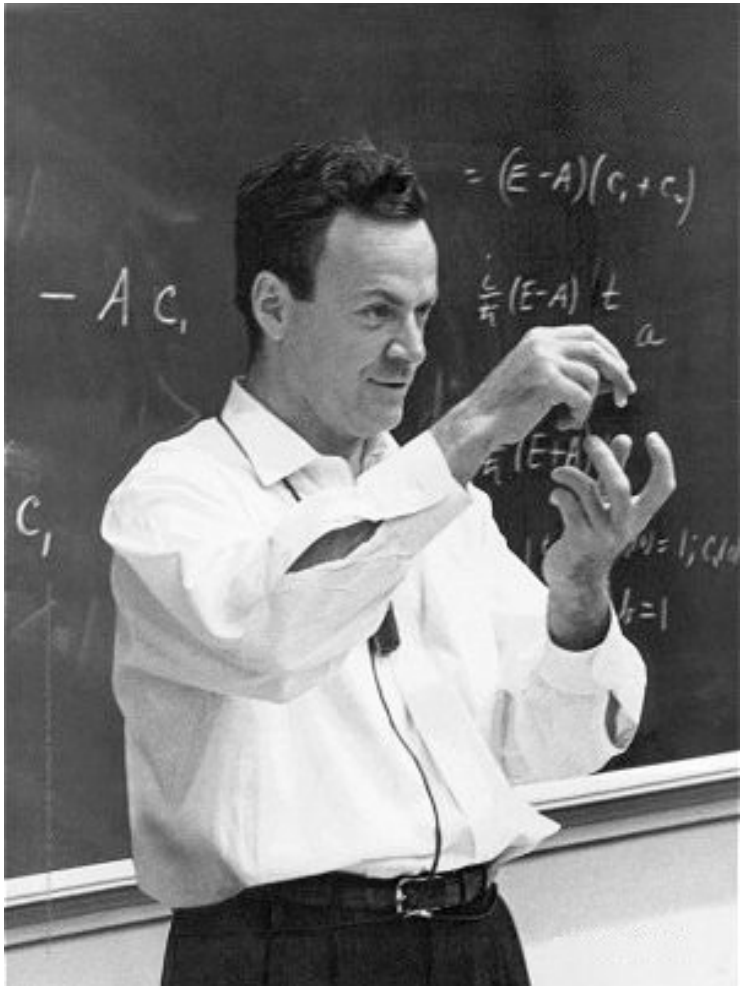
- Novel research, not a survey or a compilation of known facts
- Balance between experimental investigation and theoretical analysis
- Comprehensible, logical and interesting presentation, not a detailed description of everything-you-have-performed-and-thought-about
- Clear understanding of the validity of your experiments, and how exactly you analyzed the obtained data
- Clear understanding of what physical model is used, and why it is considered appropriate
- Clear understanding of what your theory relies upon, and in what limits it may be applied
- Comparison of your theory with your experiments
- Clear conclusions and clear answers to the raised questions, especially those in the task
- Clear understanding of what is your novel contribution, in comparison to previous studies
- Solid knowledge of relevant physics
- Proofread nice-looking slides
- An unexpected trick, such as a demonstration *in situ*, will always be a plus

How to give a science talk

- Take care of your listeners
  - if they all don't get what you say, it's your problem
  - it's your job to do science work and make conclusions. It's their job to listen
- Put yourself in context of existing results
  - your novelty is only visible in contrast with existing knowledge
  - making profound conclusions is harder than measuring and writing formulas and reading papers
  - be proud of your higher-level achievements (if you have such)
- Present a compelling argument
  - you want to say that you solved the required problem
  - saying how much you've struggled on it doesn't help the case
- Cut the non-essential information
  - if your math is thick, show only core assumptions and derived results, we trust algebra and simulations
  - if your data is big, show us trends / slopes / averaging / fits, not all of it
  - very often, less is more

Feynman: to be self-confident?

- “I’ve very often made mistakes in my physics by thinking the theory isn’t as good as it really is, thinking that there are lots of complications that are going to spoil it
- — an attitude that anything can happen, in spite of what you’re pretty sure should happen.”



R.P. Feynman. Surely You’re Joking, Mr. Feynman (Norton, New York, NY, 1985)

International Young Naturalists' Tournament

Pre-register a team!

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About the IYNT

Check the breathtaking problems!

Introduction

The IYNT is an inclusive educational network and a prestigious international competition. The IYNT is focused on student participants aged 12 through 16, the age group that has not yet chosen their favorite area of knowledge (physics, chemistry, biology, or other discipline).

Short links

- PROBLEMS 2017
- IYNT REGULATIONS
- PRE-REGISTRATION 2016

What is a Naturalist?

In their *Treatise on Natural Philosophy* (1867), Lord Kelvin and Tait give the definitions of matter, mass, force, momentum and energy that will not "satisfy the

Preparation to 30th IYPT' 2017: references, questions and advices

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Reza Montazeri Namin, [3] and Andrei Klishin [4]

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