



The United States Association for Young Physicists Tournaments  
www.usaypt.org

To: US Invitational Young Physicists Tournament (USIYPT) Team Leaders

From: USAYPT

January 25, 2021

Dear Team Leaders of USIYPT 2021,

We did a trial of the technology we're going to use for Saturday's physics tournament. It worked! We have to be prepared for things to be different and sometimes difficult... but we can run physics fights. We can share and discuss our solutions to these problems. This will work.

Please read carefully - there's a LOT here.

If you read just a few things, know **these three items**:

**1.** Team leaders and team captains are invited to the USAYPT board and member meeting on **Friday evening Jan. 29, at 9:00 PM eastern time**. We'll use the tournament director's zoom room; link will be sent on Friday during the day. Please attend! We will do ten minutes or so of USAYPT business like the treasurer's report. But then the tournament director and chief juror will lead us through the timeline of how Saturday's tournament will work. They'll take questions.

**2.** The home base for the tournament will be [this gathering on gather.town](#). The password is "replicawormhole". Feel free to go now - it's open! You can walk around and interact with people. (You'll sometimes need to close gather.town when you go to a zoom room for the physics fight rounds - if you hear an echo, just leave gather.town and come back after the round.)

**3.** All tournament announcements will be made on [this announcement board via google docs](#). Bookmark the link; the link is also available in the "shared whiteboard" in the gather.town town square. We will post zoom room links here, as well as where each team and each juror is supposed to go during each round. **If you are confused about what's happening on tournament day**, here's what to do:

- \* First, look at the [announcement board](#). It will likely tell you where you're supposed to be.
- \* Second, go to the [gather.town gathering](#), password "replicawormhole", and locate Tengiz Bibilashvili or Greg Jacobs. You might be able to find us in the "committee room" - or, you can use the "locate" function to find us. We can talk to you via internet audio or internet video; we will answer your question.
- \* If none of this works, please call or text. Greg's cell phone is 540-661-3550. Tengiz's cell phone is 818-943-7803 (text or voicemail)

That's the main idea. If you'd like to read on, I'll make several specific points about the details of physics fights online. We will take further questions on Friday night!

### **Other information about the tournament online:**

Spectators are welcome into gather.town, and into the zoom rooms for the physics fights. All should be muted! The only people who should be unmuted in zoom are the reporter, opposition, and jury members who ask questions. The chat will be disabled in zoom. But communication on our [gathering at gather.town](#) is easy and fun! Use password "replicawormhole".

Teams should send to tournament director Tengiz Bibilashvili (tbibilashvili@gmail.com) which three problems they will be reporting in the preliminary rounds. Please send that as soon as you know for sure; that might be now, but that must be by Thursday Jan. 28. Tengiz needs (!) that information in order to set the room assignments in the preliminary rounds. (In each preliminary round this year, all two or three teams in the room will take turns presenting the same problem.) Though there is minimal or no strategic advantage this year to declaring publicly which problem your team is rejecting, Tengiz will keep that information confidential between himself and the head jurors.

The four official team members are allowed and encouraged to communicate with each other during a round by any method - text message is probably best (unless you're all in the same room and can use post-it notes as at the real tournament!), but whatever works for you is fine. Zoom chat will not be available.

Communication between team members and team leaders should not happen during a round. Team leaders are encouraged to coach their team in between rounds.

The report must be pre-recorded and sent to the chief juror via the instructions sent separately - we'll re-send those instructions on request. You must have three reports sent in by the end of day Thursday Jan. 28.

You may re-record your report and send an updated version at any time on Friday, or even on Saturday. But... while we will make our best effort to upload the latest recording, if your recording is sent very late, or if you send a bobzillion recordings, they might not get uploaded.

In the final round, the reporter is allowed to do a live report rather than use a pre-recorded report. But if technical difficulties occur, the head juror may just run the pre-recorded report for clarity. Or, the reporter may choose to use the pre-recorded report.

Opposition time limits are a bit different in this online tournament. Opposition gets 10 minutes to question the reporter. There is no separate preparation time. It is acceptable to spend a minute or two discussing with your team before beginning the questions; however, that time is part of the allotted 10 minutes.

It is expected that the reporter will share their screen to show slides during the conversation with the opposition. Please, please, number your slides! Then it's that much easier for the opposition to say, "On the graph in slide 9, could you describe where you get the vertical axis values?"

**Opposition and conversation online etiquette is different.** Without in-person body language and facial expressions, it is sometimes difficult to communicate things like "thank you, you've answered my question" or "oh, wait, you misinterpreted my question". We expect that the opponent may occasionally need to interrupt the reporter in order to move the conversation along; we expect that the reporter may need occasionally to cut off a question to clarify a point. And online conversation sometimes naturally leads to people talking over one another due to connection lags. Sometimes interruptions sound aggressive; online, though, sometimes aggressive-sounding interruptions are unavoidable. We ask everyone to be patient with one another. As long as we are all searching for the truth, as long as every opponent is trying to find physically interesting and relevant lines of questioning, then we simply must understand that online conversations will sometimes sound awkward or even impolite. We expect good faith from all participants; we don't expect perfect etiquette. We are all doing our best.

We are NOT going to record the physics fight rounds. We ask that others don't, either. What happens in a round is a one-time experience just for those present. We'd encourage you to send out portions of your own team's pre-recorded video for publicity purposes at your school.

Thank you for reading this far. Please send questions. We will see you Friday night!

USAYPT

## **Tentative tournament schedule**

(all times US Eastern Standard time i.e. New York):

9:15 am	Juror training
9:45 am	Opening ceremony
10:00 am	PF Round 1
11:30 am	PF Round 2
1:00 pm	Lunch break Use Gather.town to interact during the lunch
1:30 pm	PF Round 3
3:15 pm	Announcement of finalists
3:30 pm	Final Round
5:15 pm	Awards/Closing

## **USIYPT 2021 online - participating teams**

School name	Primary team leader
Rye Country Day School	Mary Krasovec
Nueva School	Mark Hurwitz
Qingdao No. 2 High School	Peng Li
Woodberry Forest School	Greg Jacobs
Phillips Exeter Academy	Scott Saltman
Philips Andover Academy	Mika Latva-Kokko
Vanke Meisha Academy	Ivan Tsang
Shenzhen Middle School	Zhang Mei
Harker School	Mark Brada, Miriam Allersma
Episcopal High School	Kacey Meaker
Cary Academy	Matt Greenwolfe/Charlotte Kelly

## Pre-recording of reports:

Before 11:59 pm eastern time on Thursday January 28, each team must share their reports with Peter Sheldon, the chief juror. Please save your video(s) to a file sharing service such as Google Drive, Dropbox, iCloud, Azure, OneDrive, etc. Share your file (do not e-mail the file as an attachment) with Dr. Sheldon at [psheldon@randolphcollege.edu](mailto:psheldon@randolphcollege.edu). If there are any problems with sharing with that email, please then share it with The United States Association for Young Physicists Tournaments [petersheldon@comcast.net](mailto:petersheldon@comcast.net). If you prefer, or if you do not have easy access to any cloud storage/file-sharing, please e-mail Dr. Sheldon at the email addresses provided, and he will send you an individualized web link where you can share your file. Do not share your file as a YouTube video, as we would like to have all the videos in one YouTube location from where we can manipulate them.

These recordings **must be done in a single take**. No advanced video editing is allowed. Jurors will be instructed to evaluate each report on the quality of physics presented, not on the technical aspects of the video such as lighting, audio quality, background, etc. We recommend using zoom - open zoom, share the screen so the slideshow is on the main screen, then hit record. The report has a strict time limit of 10 minutes.

# Problems for The USAYPT Invitational Tournament

North Carolina State University  
January 30 , 2021

## Chatter Ring

The *Chatter ring*, also *Gyro ring* or *Jitter ring*, is a toy with small spinning rings, called *beads*, around a big hoop, called *the ring*. The goal is to keep all of the beads spinning for as long, and as fast, as possible.\*

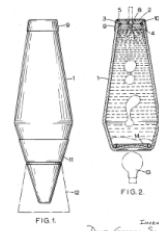
Investigate how one works, both experimentally and theoretically.



## Lava Lamp

Edward Craven Walker and David George Smith invented the Lava Lamp in 1963†, and it soon became a fad, remaining popular throughout the 1970s.

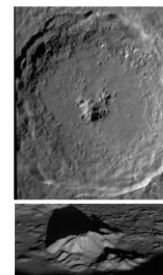
Investigate, both theoretically and experimentally, the physics of lava lamps.



## Modeling Impact Craters

What happens when a large rock hits a planet or moon? Does it matter if it hits the water or land? How much kinetic energy does it take to produce a crater of a particular diameter? Where does this energy go during the impact? What forms the central peaks found in some lunar craters such as *Tycho*‡ shown.

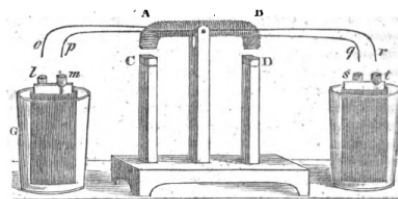
Conduct experiments designed to reproduce the shape of various terrestrial and lunar craters. Use your experimental results, and appropriate scaling relations, to estimate the energy needed to produce observed impact craters. How do your results compare with estimates from the scientific literature?



## Joseph Henry's Rocking Motor

In 1831 Joseph Henry invented the first electromagnetic motor, or as he put it: "I have lately succeeded in producing motion in a little machine by a power, which, I believe, has never before been applied in mechanics—by magnetic attraction and repulsion."§

Read Henry's article and reproduce his experiment. Clearly explain how it works using Henry's reasoning, and then using modern electromagnetic field theory. Next, design and build, a solar powered electromagnetic rocking motor optimized for pumping water in an arid rural area.



\* The *Chatter Ring* has been marketed also under the names *Gyro Ring*, *Jitter Ring*, and *Flitter Ring*, with a retail price of under US\$20.

† The figure is from US patent US3387396A, which was filed along with UK patent GB1034255A, on March 18, 1964.

‡ The top figure is a mosaic of images taken with the Lunar Reconnaissance Orbiter, by scientists at NASA/Goddard and Arizona State University, while the bottom is a view of the central peak by the same team.

§ Henry, Joseph, *On a Reciprocating motion produced by Magnetic Attraction and Repulsion*, *American Journal of Science and Arts*, (1831) Vol. XX, No. 2, Art. XVII, pp. 240-343.

USAYPT Juror Form – REPORTER: \_\_\_\_\_

FINAL SCORE: \_\_\_\_\_

Round #: \_\_\_\_\_ Problem Name: \_\_\_\_\_

Juror Name: \_\_\_\_\_

Theoretical Solution	Theory	Experimental Evidence	Expt	Questions & Answers	Q&A
<b>EXCELLENT: clear, comprehensive, and detailed solution</b> -- <i>all approximations</i> and assumptions are stated and relevant -- <i>all concepts</i> and principles used are stated clearly and relevant -- mathematical model is extensive, explained clearly, and shows <b>excellent</b> understanding	4	<b>EXCELLENT: extensive experiments with advanced data acquisition, analysis, and presentation</b> -- design is <b>extensive</b> realization of theory model -- uses <b>advanced</b> data acquisition techniques -- uses <b>advanced</b> data analysis techniques -- presents data in <b>appropriate and easily understood</b> forms -- compares theory and data <b>properly</b>	4	<b>EXCELLENT: demonstrates deep understanding of the relevant physics in defense of the solution</b>  <b>BASIC: demonstrates basic understanding of the relevant physics in defense of the solution</b>	2  1-1/2  1  1/2
<b>GOOD: partially clear, but comprehensive and detailed solution</b> -- <i>most</i> approximations and assumptions are stated and relevant -- <i>most</i> concepts and principles used are stated and relevant -- mathematical model is <b>partially</b> developed, explained, and shows <b>good</b> understanding	3	<b>GOOD: partial experiments with advanced data acquisition, analysis, advanced presentation</b> -- design is <b>partial</b> realization of theory model -- uses <b>advanced</b> data acquisition techniques -- uses <b>advanced</b> data analysis techniques -- presents data in <b>appropriate and easily understood</b> forms -- compares theory and data <b>properly</b>	3	<b>UNACCEPTABLE: has extreme difficulty handling questions</b>  <b>CONSIDERATIONS – during the reporter's defense of the solution:</b> -- How does the reporter identify and use the applicable principles of physics? -- How does the reporter explain the theoretical model's conclusions? -- How does the reporter explain the experimental apparatus and the data obtained?	0
<b>BASIC: partially clear, but not comprehensive nor detailed solution</b> -- <i>some</i> approximations and assumptions are stated and relevant -- <i>some</i> concepts and principles used are stated and relevant -- mathematical model is partially developed, explained, and shows <b>basic</b> understanding	2	<b>BASIC: partial experiments with limited data acquisition and analysis, and basic presentation</b> -- design is <b>basic</b> realization of theory model -- uses <b>limited</b> data acquisition techniques -- uses <b>limited</b> data analysis techniques -- presents data in <b>basic</b> forms -- compares theory and data <b>properly</b>	2	-- How does the reporter use their data to support their conclusions? -- How does the reporter handle questions they were not prepared for? -- How does the reporter listen, speak, and maintain poise?	1-1/2
<b>POOR: unclear, not comprehensive, nor detailed solution</b> -- <i>few</i> approximations and assumptions are stated and relevant -- <i>few</i> concepts and principles used are stated and relevant -- mathematical model is <b>shallow</b> , poorly explained, and shows <b>little</b> understanding	1	<b>POOR: flawed experiments with inadequate data acquisition, analysis, and presentation</b> -- design is <b>flawed</b> realization of theory model -- uses <b>inadequate</b> data acquisition techniques -- uses <b>inadequate</b> data analysis techniques -- presents data in <b>inappropriate</b> forms -- compares theory and data <b>inappropriately</b>	1	-- How does the reporter use their data to support their conclusions? -- How does the reporter handle questions they were not prepared for? -- How does the reporter listen, speak, and maintain poise?	1/2
<b>UNACCEPTABLE: no relevant theoretical solution</b>	0	<b>UNACCEPTABLE: no relevant experimental evidence</b>	0	-- How does the reporter use impromptu visual aids in defending their solution?	0