Exploring and Applying Physics

Facebook group

Posts by Eugenia Etkina from 2025

Eugenia Etkina
Admin

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Hi all! In 9 days (January 11) we will have a workshop on teaching Quantum Optics through the ISLE approach. In the next days I will be posting the material that the students should learn before they approach this topic. I will also connect it to the workshops that we have had so far. If you plan to attend this workshop, please make sure that you read every post in the next 5-7 days. As many of my posts are invisible, the only way for you to be prepared for the workshop is to check the group daily.
So far we have had two workshop on optics - in the first one we learned how light travels in different media, how extended objects emit light rays and what models of light existed first. We learned how to reject a particle-bullet model of light but we did not come up with another model. In the second workshop we learned the wave model of light and how Huygens principle helps explain many light phenomena - propagation in media where the speed of waves changes, going through small obstacles, and interacting with thin films.
Although the wave model of light explains many phenomena that the particle-bullet model cannot, it says nothing about the nature of the waves - what is waving in a light wave?
To answer this question our students need to delve into electromagnetism. Specifically, in the electric and magnetic fields and electromagnetic induction. We had workshops on all those topics, and if you missed them or are unsure about the content, you can watch the recordings posted at https://drive.google.com/.../1sQvQBi2v7hoyZNGYXFEJPxNfjYi...
Alternatively, you can study Chapters 18, 19, and 21 in the textbook College Physics: Explore and Apply.
If you plan to attend the workshop on January 11 and do not have the textbook, please email me as soon as you see this post at eugenia.etkina@gse.rutgers.edu and I will help you obtain an examination copy.
These three chapters are a first step in the preparation. There will be more. Please stay tuned!

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Eugenia Etkina
Admin

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Hi all, I continue posting the materials in preparation for the Quantum optics workshop. Yesterday I posted the links to the workshops of Electric field, Magnetic Field and Electromagnetic induction that address the foundational knowledge that students need to understand quantum optics ideas. But there is another topic that we did not have workshops on that is crucial for this process - it is understanding what is waving in a light wave. The material is in Chapter 25 in our textbook, but here I am posting a selection from the chapter

related to the essential ideas. If you plan on attending the workshop, please read this text if you have not taught electromagnetic waves in a while. It is from our textbook.
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Hi all, on January 3rd I posted a short summary for electromagnetic waves for those who plan to attend our Quantum Optics workshop on Saturday at noon EDT, 9 am PST and 6 PM CET. If you missed that post and plan to attend the workshop, please read!
Today I am posting a section form our textbook related to the black-body radiation. It is necessary for use to move to the photoelectric effect - the topic of the workshop. Please read if you are planning to attend.

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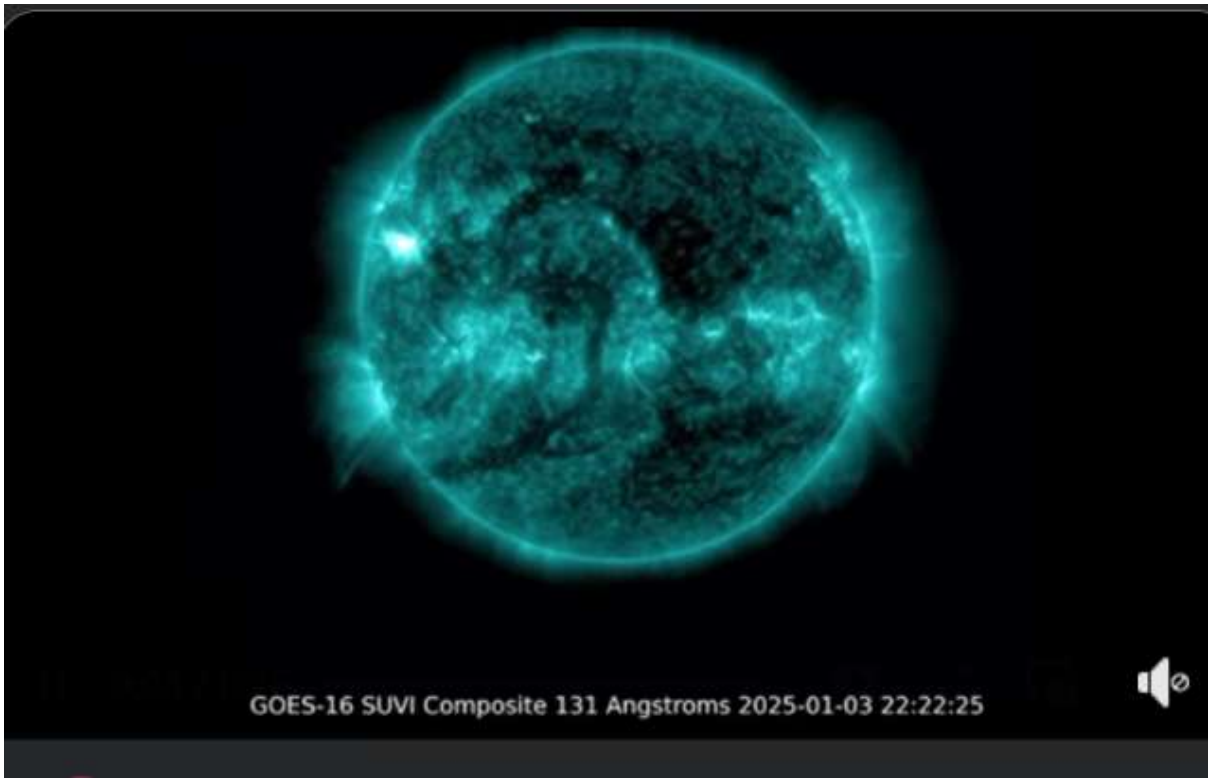
If you are teaching magnetism now, this is a great application of the interaction of magnetic fields with plasma. Asking students to find out why these events are happening is a good project after they have learned magnetic force exerted on moving charged particles. The ISLE process for every concept ends with "Application experiments" - this is a perfect example of such!



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Eugenia Etkina

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Good morning! Thank you all who attended the Quantum Optics workshop yesterday. We had one of the largest groups ever! The workshop was long and we still did not finish everything. You will see in the slides how far we went. If you wish to learn the rest - do the activities that I planned there and pose questions here. I think the most important takeaway from the workshop is how this topic is representative of the history of science and the change of science models.

A photon model is not a particle model of light and it is not a wave model of light, it is a completely different thing that has no analogies in our world.

More, it is even not the last model of light created by physicists. If you wish your students how science really works - the photoelectric effect history is a beautiful example.

I am posting the link to the slides and the ALG, the recording and the reflection slide. This time all reflections did not fit on one slide!

I asked the participants what next workshop we should run, and the agreement was to return to fluids, static fluids and fluids in motion. I will announce the date tomorrow.

Link to the workshop folder

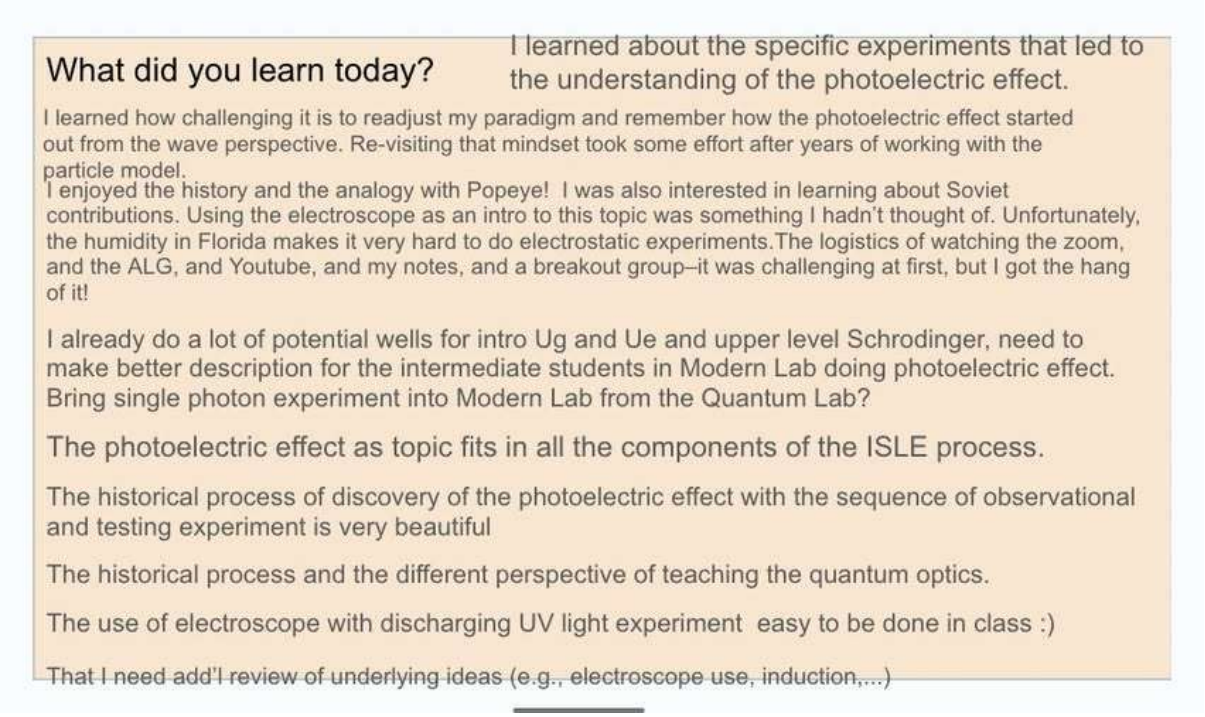
https://drive.google.com/.../1Qf1G7ySTZYrRtcDWuCtig...

Recording of the workshop

https://rutgers.zoom.us/.../sB-H7IxJUD7-olD...

Password: K2D@G6ys

Again, thank you all who participated yesterday!



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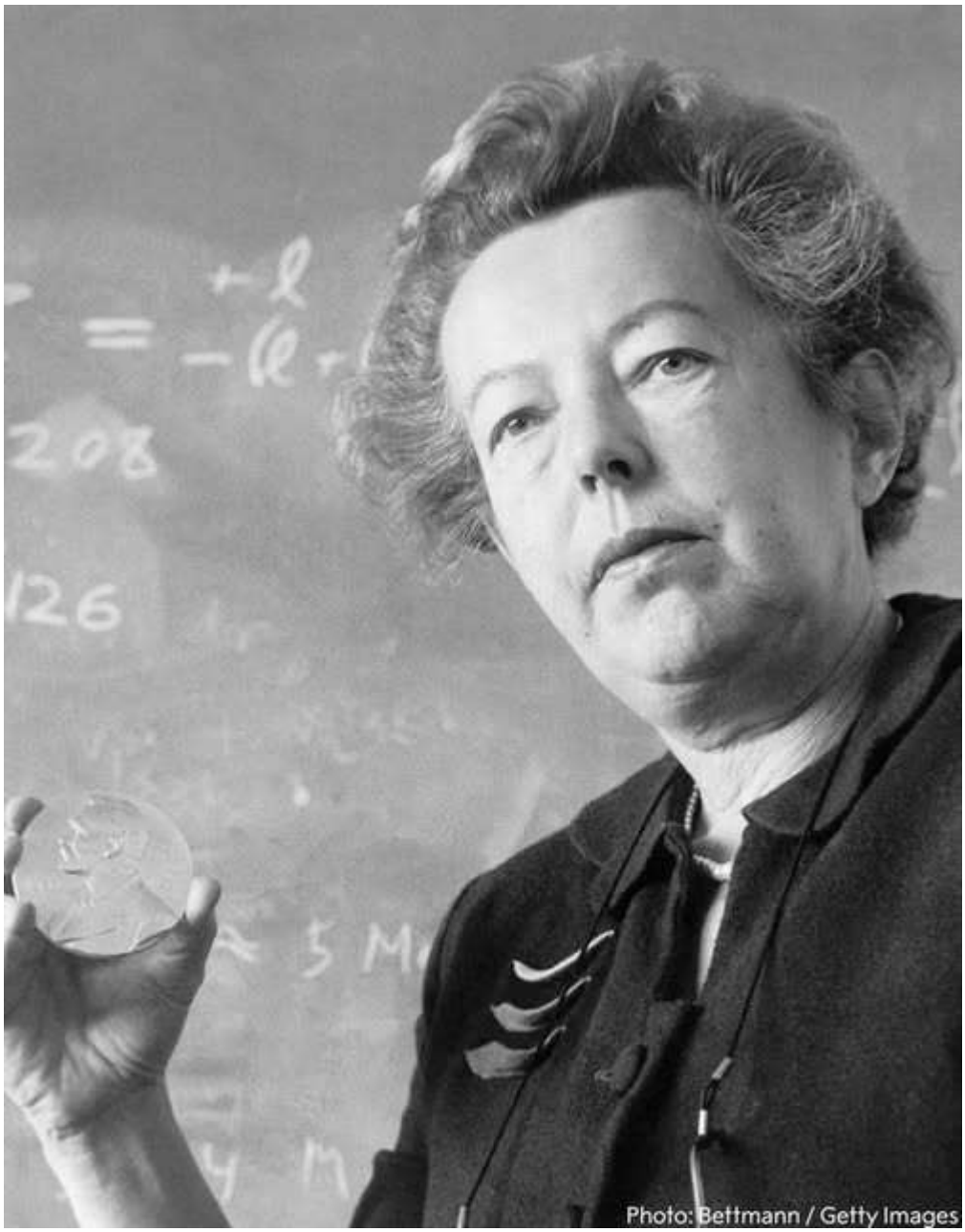

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Eugenia Etkina

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I am sharing the post of Martín Monteiro about Sofia Kovalevskaya. I great up hearing her name often from mom mom who was a math teacher. She saw Sofia as a role model. Thank you, Martín Monteiro, for posting about her!

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Eugenia Etkina

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Hi all, two things today: first, please sign up for the Static Fluids workshop on Feb 8 if you are interested in attending. The link is in your EVENTS on Facebook. If you cannot find it, please comment here and I will send it to you.
Second, a few days ago Bor Gregorčič raised an interesting question about abductive reasoning and its role in the ISLE process. Eugenio Tufino suggested that we discuss the

differences between the inductive reasoning and abductive reasoning in forming hypotheses/explanations in the ISLE approach. Here is a comparison.
Inductive Reasoning
Definition: A reasoning process that involves generalizing from specific observations to broader generalizations or theories.
Goal: To derive probable conclusions based on patterns or trends.
Example:Premise: "Every swan I've seen so far is white."
Conclusion: "All swans are white."
Key Characteristics:
Moves from specific to general: Observations lead to a general rule or theory.
Probabilistic: The conclusions are not guaranteed to be true, even if the premises are correct.
Used in science and everyday reasoning: Often used to form hypotheses, make predictions, or infer patterns.
Strengths:
Helps identify trends and make predictions.
Can lead to the discovery of new models.
Weaknesses:
Susceptible to confirmation bias.
Limited by the quality and quantity of observations (e.g., "black swans" disprove the earlier generalization).
Abductive Reasoning
Definition: A reasoning process that involves inferring the most likely explanation for a set of observations or facts.
Goal: To find the best explanation (not necessarily certain) based on available evidence.
Example: Premise: "The grass is wet."
Conclusion: "It probably rained." (Though other explanations, like sprinklers, are possible.)
Key Characteristics:
Moves from effect to cause: Seeks the most plausible explanation for observations.
Inference to the best explanation: Often involves choosing the simplest or most likely hypothesis (Occam's razor).
Common in diagnostics and problem-solving: Used in fields like medicine, law, and detective work.
Strengths:
Highly useful in conditions of uncertainty or incomplete information.
Encourages creative hypothesis generation.
Weaknesses:
Conclusions are not definitive and may be wrong if alternative explanations are overlooked.
Relies on subjective judgments of "most likely" causes.
So, it looks like we use both and this means that if our students learn physics through the ISLE process and develop reasoning skills that we help them develop, those skills will be useful in an profession they choose. But remember, the most important reasoning skill that the ISLE approach develops is hypothetico-deductive reasoning, I will comment on it tomorrow.

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Eugenia Etkina

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Hi all, yesterday I posted a comparison of the inductive and abductive paths of reasoning. Today I am adding the most important part- hypothetico-deductive. I am providing the link to the Wikipedia article about it. While I completely agree with what they are saying, they (and all others who I found on the internet) are not articulating explicitly one crucial step in this logical chain, without which it is impossible to teach students how to reason this way. This crucial step is designing a new experiment (a testing experiment) before making a prediction. Without knowing what experiment you are going to run, one cannot make predictions. Please read what they are saying and tomorrow I will post the steps that we recommend to follow to help students develop this type of reasoning. Why is it important to think hypothetico-deductively?
Here is hte Wikipedia link.

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Eugenia Etkina

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Hi all, yesterday Anne Caraley and I had a very interesting conversation about student motivation. How do we motivate our students to read the textbook, to work on homework problems, etc. As you probably know, there are two kinds of motivation - intrinsic and extrinsic. The former is due to the internal interest in the issue and the latter is due to external rewards (grades are one of those). Research shows that extrinsic motivation kills the intrinsic one. Once you offer a person interested in something a reward for doing it, they stop wanting to do it on their own. How contrary to the educational experience this is! We continuously destroy our students intrinsic motivation by offering them rewards for good work. I intuitively knew it from personal experience but listening to a podcast The Hidden Brain (where they interview researchers on selected topics) taught me that this is actually a research finding. So, how to maintain students' intrinsic motivation in a setting that deliberately destroys it?
I have several ideas, and I implemented many of them successfully in my 40+ years of teaching (my former students, members of this group can confirm). First, I try to show that physics is cool by always being excited about it myself. I let my students experience a shot of dopamine when they working in groups solve a problem that none of them could solve on their own. I make them reflect on this feeling. I continuously emphasize that everyone can experience this feeling if they try. I show them again and again that they are getting better at something. I show them that I expect them all to be motivated and successful as physics is

the coolest thing in the world. I downplay the role of grades or tell them that everyone can get an A - they just need to work to deserve it. I reward good work with more work. I say: You solved this difficult problem, now you deserve a new one that is even cooler! I make them gasp seeing cool experiments and then being able to explain them or make a prediction based on the idea that they just created and see that it works. This is the best motivation actually. I rollerblade in class and let them push me and through medicine ball at me. I purposefully attract their attention to a person in class who made .good comment/posed a good question that changed the direction of the lesson. I make them feel good about themselves doing physics. And I let them make their own decisions as much as possible - what experiment to do, what question to pursue, how to evaluate their work, what to put on the test (I posted about it some time ago), etc.
As you see, there are many things we can do to grow their intrinsic motivation and diminish the extrinsic one. Please share your methods and tools how to do it.

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Eugenia Etkina

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Paul Wolf was interested in my approach in including students in the design of the final unit tests. Here is what I did in the last 5 years of my high school teaching:
I gave an assignment to my students about 5 days before a final unit test (in groups). They needed to make a list of the goals of the unit and then to design a test that assesses these goals. There should be 5 problems on the test that can be solved in 45 minutes. They needed to explain what goals each problem assesses and to make sure that all goals were covered. They needed to solve the problems too. In the lesson before the test each group presents the list of goals - share on the screen for the class and argue how their problems assess the goals. They hand in their work separately - with the solutions. They do not present solutions in class. Each group has about 7 min to present(6 groups, 42 min in a 45 min lesson), so they need to be very careful about their presentations. I chose the best problems for the test and this way some of the groups got the problems that they designed and solved. They were so proud when they saw their problem on the test!

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Eugenia Etkina

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Hi all, I posted a few days ago about changing the place for our group. Your support for leaving this platform was overwhelming. Since then, Jim Flakker and I (mostly Jim, I just comment and provide general support) have been working on the new platform. But we cannot move forward presently without a few users - to try the tools, give feedback, etc. Thus, this post is to invite volunteers - 3-5 to become "piloters" of the new platform. We will explain everything at the meeting on zoom on Monday February 3rd at 7 pm Eastern Time (EDT). The zoom link is below. Please comment if you can join. Your participation is very important for making the platform better. Please help!

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Eugenia Etkina

One more post about Lise Meitner. She was an incredible person and her contributions to our understanding of fission are super important. And yet... ShHe did not get the Nobel prize for her work. One of many.

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Eugenia Etkina

Hi all, Eugenio Tufino reminded me of an important document that you might find useful, especially if you are new to the ISLE approach. The document mentions a workshop where you learn more. his summer we will have two introductory 8-hour workshops - one in person at the AAPT in DC (look for it when the meeting information is available) and the other one

online in July (the date TBD), this one runs for 2 days, 4 hours per day. If you are interested in attending online, please comment here, so that I can see if there is interest. Here is the link to the document. I am not tagging everyone to see how many will see the post without tagging.

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Eugenia Etkina

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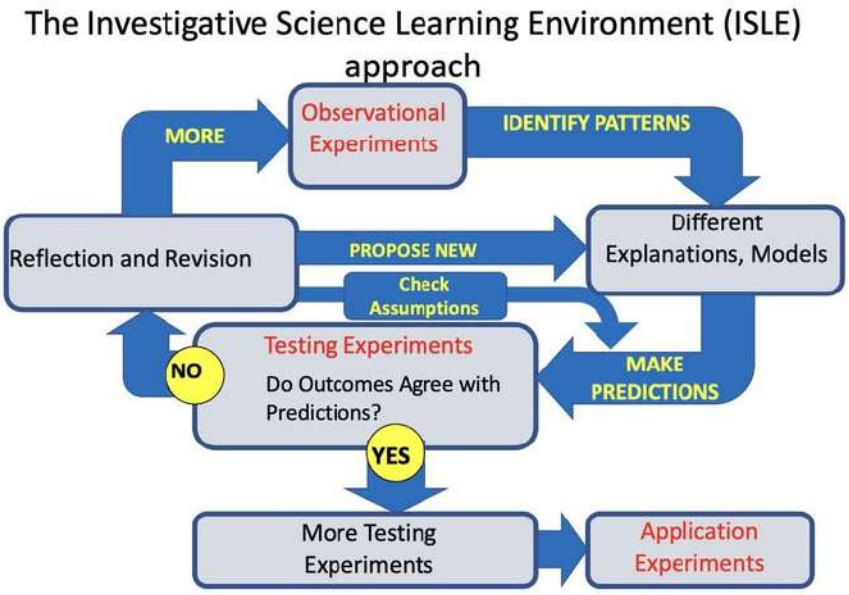
Hi all, in my experience (preparing over 150 physics teachers and working with numerous college faculty in the past 25 years) it takes a significant amount of time and effort to ISLEize your mind enough to seamlessly integrate ISLE process (and activities) into your teaching (those who have been doing it for a while have this experience).
Although we naturally think following this process when making decisions (buying a house, a car, deciding on a relationship, etc.) and the physicists use it daily doing physics, it is not a way of thinking that we use "in school", and it is not a way of thinking when most teachers plan their lessons.
Attending an introductory workshop is a first step in the development of ISLE thinking. It is in this workshop where you see the where ISLE comes from and how it applies to every concept that you wish your students to learn.
While we have monthly workshops dedicated to different concepts, it is the introductory workshop that helps you see the logic in everything else that we do. Thus, even if you attended some of the monthly workshops, I still strongly recommend to participate in the introductory workshop.
We are working on the dates and so far it looks like the week of July 14 is the week when we will do it (the exact days TBD). Yesterday 7 people commented that they are interested in attending. Please read my yesterday's post and comment here if you are interested. 4 hours a day, 2 days, online, free, certificate for 10 hours of PD (as there is homework). In my experience, we need about 30-40 interested people to have 14-20 attending for a productive workshop.



Etkina and Van Heuvelen, 2001, 2007; Etkina, 2015, Etkina et al., 2019

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Eugenia Etkina
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Hi all, a lfew things today. First, I am reminding those who plan to attend that we have a pilot meeting of a new platform at 7 pm EDT tomorrow. I will put the zoom link in the comments.
Second, on Saturday we have our Fluids workshop. Those who signed up for it need to do some homework and prepare equipment. The homework is to read Chapter 12 - Gases, the chapter for which the workshop is, is #13.
Second, here is the stuff to prepare.
A plastic bottle with holes along a perimeter (I use a bottle from sparkling water)
The same bottle with holes along the side and at the bottom (see the video)
[https://youtu.be/_-rqbLpfSho](https://nam02.safelinks.protection.outlook.com/...)
An empty glass (wine glass is best, it needs to be transparent)
A bottle with vegetable oil (we need a little bit)
A pitcher with water
A tray to collect water (I use a baking tray)

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Eugenia Etkina

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Another great physicist without credit for her work. She was the first to propose the idea of fission when Fermi could not explain the results of his experiments bombarding Uranium with neutrons... But nobody listened.

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Eugenia Etkina

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Hi all, two things today: 1) I am reminding about Static Fluids workshop on Saturday, noon US East Coast time. The workshop is free, it lasts for 2 hours and you can get a PD certificate for those 2 hours. I posted homework (including materials preparation) twice in the last 5days, so please scroll down and find what to do.
The zoom link is https://rutgers.zoom.us/my/etkina...
2) Tim Timothy Magill posted a question yesterday about a possibility of a student enrolling in AP 2 without taking AP1. I responded saying that it is not a good idea unless a student can learn Forces and Energy on their own. Timothy Magill and David Sturm asked me to elaborate. Here is my thinking.
Teaching students to learn on their own is an important part of our education. Imagine a student who wants to take AP2 next year without taking AP1 this year. You make an assignment for this student to work in the summer though the ALG activities/textbook (our textbook) for the specific chapters and schedule a few sessions to assess them on specific questions that you do not share in advance - take some form the textbook and the ALG. I have had many students who would be able to do it. But you need to teach them the elaborate interrogation method of working with a scientific text first (we do it in our introductory ISLE workshop). Once they learn how to work with the text and do the activities, they can move forward.
A personal story: When I was taking physics in high school, in the middle of the year I had an appendectomy and had lots fo complications - I missed almost two months of school. It was magnetism and electromagnetic induction. I taught myself these topics and when I came back, I knew them better than many of my classmates. This is just one example and it is not statistics, of course, but I just wanted to share that it is possible, if a person knows how to learn. Does it make sense?

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Eugenia Etkina

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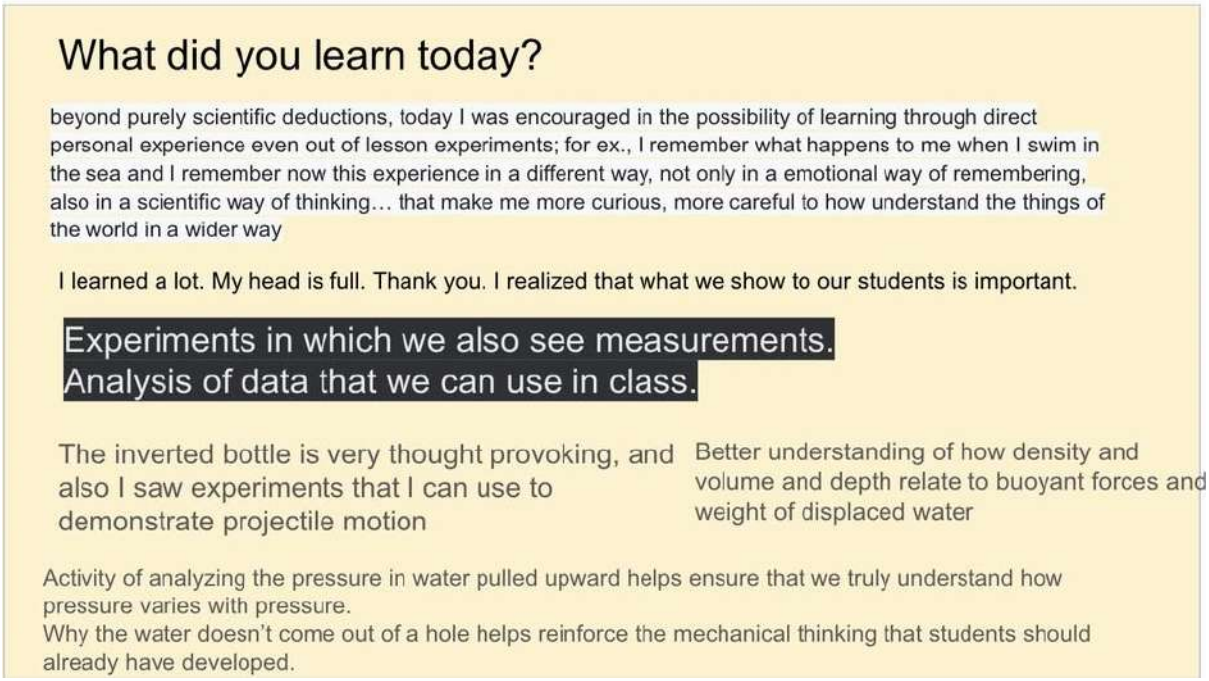
Hi all, we had a very productive workshop today. Thank you all those who came and made it possible to have a really great experience for everyone. An amazing thing happened today. We had a guest who was not a physics teacher, but a teacher of literature, history and even theatre. She was interested in the ISLE approach as she read the second ISLE book. She was able to work in a group so well that her groupmates did not realize that she was not a physics teacher. This speaks to the ISLE approach as a unique equalizer - everyone has a voice and can contribute. I am pasting the link to the recording, the link to the google folder with all the materials and the reflection slide (we were running late, so not everyone had time

to write there). The next workshop is on Fluids in motion. Please comment here is you are interested in it. If you have wishes for other topics for out workshops - please comment too!
Recording: https://rutgers.zoom.us/.../tF89eb...
Password 2mL2x@hU
Link to the workshop materials
https://drive.google.com/.../1JN3YuiFEgQjy0E0aRAKvhz12tnK…



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Eugenia Etkina

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Please read the first quote in the shared post. This is exactly what we are doing when we use the ISLE approach to help students learn physics. If you need support for your conversations with students, parents and administration, this quote might help.

https://www.facebook.com/groups/320431092109343/posts/1808585303293907/?__cft__[0]=AZWZmjgrPcACCWxjEMlb-KSSHOv8fgB_a81N2QA9uNuMr1jYvvQkKS5ydbpU1IKyGcbfinG3rQV0ob8oIvSwbEkYmAhriGaaXCSeFX8h5nTQgR2a-DfJ6LQz5XXpo0mxraqW9ZADxeJ_22YquOsERkQNXVsCzU9xkWdYenzaufKgLanI-smFcdxoZqsnh-VvvFln_SL4IIOD3Lrs_uNocD2BprmJeBdiPSbOlZBfg1bINw&__tn__=%2CO%2CP-R

Eugenia Etkina

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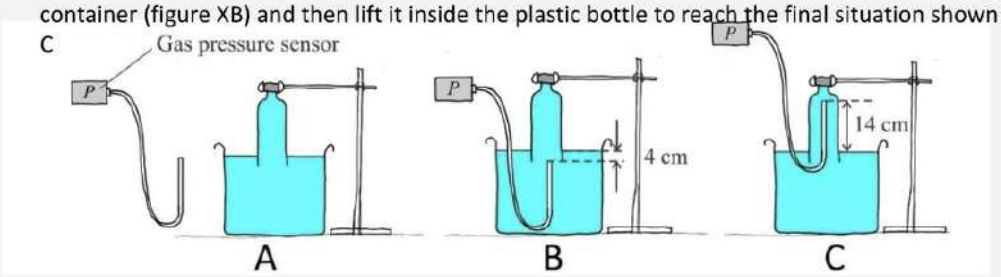
Hi all, when we had our Fluids at Rest workshop on Saturday, there was one problem that will be in our new eiditon that was challenging for the participants.I am pasting the screenshot below. What do you think about the answer and why is the problem difficult?

You have a plastic bottle with the bottom cut off and tightly sealed with a cap. The bottle contains water and is partly immersed in a large water container as shown in the figure below. You also have a gas-pressure sensor that is initially showing the ambient pressure. The sensor measures the pressure at the end of a tube that is connected to it. You first immerse the end of the tube into the larger container (figure XB) and then lift it inside the plastic bottle to reach the final situation shown in figure C



Compare the pressure readings in steps A, B, and C quantitatively. Assume that the ambient pressure outside water is 100.0 kPa. Explain your answers.

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Eugenia Etkina

Hi @everyone! We are ready to move to a new platform. All credit goes to Jim Flakker. He worked for a month to make it work, and it is easy to use and easy to communicate through. I am also grateful for the help of all those who partiicpated in our pilot session.

Here are the instructions on how to join. As I anticipate many people joining in the first few days, please be patient with me approving you. And please sign up for the Fluids in Motion workshop either here in the EVENTS or on the few forum. I will not remove this group, so that the new members can see where to go, but I will not post new stuff here anymore.

How to Register for the ISLE Physics Forum

Welcome to the ISLE Physics Forum! Follow these steps to join our community:

1. Go to the Forum:

Visit islephysics.net/forum and click 'Register'.

2. Accept Forum Rules:

Review and agree to the guidelines.

3. Complete the Registration Form:

- Username (Display Name): Choose a recognizable name (visible only to registered users).
- Email Address: Enter a valid email (used for login).
- Password: Create a secure password.
- Required Questions: Provide your location and explain why you wish to join.

4. Complete CAPTCHA:
Confirm you are human.
5. Submit and Activate:
- Click 'Register' to submit.
- Check your email for an activation link and click it.
6. Log In:
Return to the forum, click 'Login', and enter your email and password.
7. Join the Conversation:
Start exploring topics and participating in discussions!
ISLE Physics Forum | islephysics.net/forum

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Eugenia Etkina
Admin

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Hi all, if you appleid to the new platform but were not admitted, lease check your email and reply to it, as without you replying the system will think that you are a bot. PLEASE read instructions on how to join carefully. Thank you!

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Eugenia Etkina

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Hi @everyone! The group has migrated yesterday. Over 150 people already signed up for a new platform. If you have not yet, here are the instructions. And please make sure you read them carefully - they involve you replying to an email sent by the site for the confirmation that your email is real. Do not miss this step!
How to Register for the ISLE Physics Forum
Welcome to the ISLE Physics Forum! Follow these steps to join our community:
1. Go to the Forum:
Visit islephysics.net/forum and click 'Register'.
2. Accept Forum Rules:
Review and agree to the guidelines.

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- Username (Display Name): Choose a recognizable name (visible only to registered users).
- Email Address: Enter a valid email (used for login).
- Password: Create a secure password.
- Required Questions: Provide your location and explain why you wish to join.
4. Complete CAPTCHA:
Confirm you are human.
5. Submit and Activate:
- Click 'Register' to submit.
- Check your email for an activation link and click it.
6. Log In:
Return to the forum, click 'Login', and enter your email and password.
7. Join the Conversation:
Start exploring topics and participating in discussions!
ISLE Physics Forum | islephysics.net/forum

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