September 2023 - Quantum Physics

Answer Sheet

Physicists were long mystified when studying quantum phenomena.
They finally realized that sometimes things could be two things at once!

Tonight

- We're here to help! This is not a competitive event. Ask the Game Control volunteers (GC) for hints as often as you'd like. The goal is to have fun, not to be frustrated!

The Puzzles

- Each puzzle's solution is a short word or phrase. How do you find it? That's for you to discover!
- Need a code sheet or solving resources? Check out the Resources page on Puzzled Pint's webpage: http://www.puzzledpint.com/resources/
- You can use anything to help solve: Use your phone: the internet is fair game! Think your brother might have an insight? Give him a call!
- While each month has a theme, you need no special knowledge of the theme to solve the puzzles.

About Puzzled Pint

- We're an all-volunteer organization.
  - Help us run locally: Talk with Game Control about how you can volunteer.
  - Help us run globally: https://www.patreon.com/PuzzledPint

Team Name:	**Start Time:**
Team Size:	**End Time:**

Puzzle Answers	
Lasers	
Nuclear Decay and Antiparticles	
Many Worlds Interpretation	
Uncertainty Princip	
Checkpoint! Have GC verify your answers to receive the Meta and Bonus puzzles.	
Meta	
Bonus: Double-Slit Experiment (optional)	

How did tonight go? Email feedback@puzzledpint.com or fill out the survey with the QR code above.

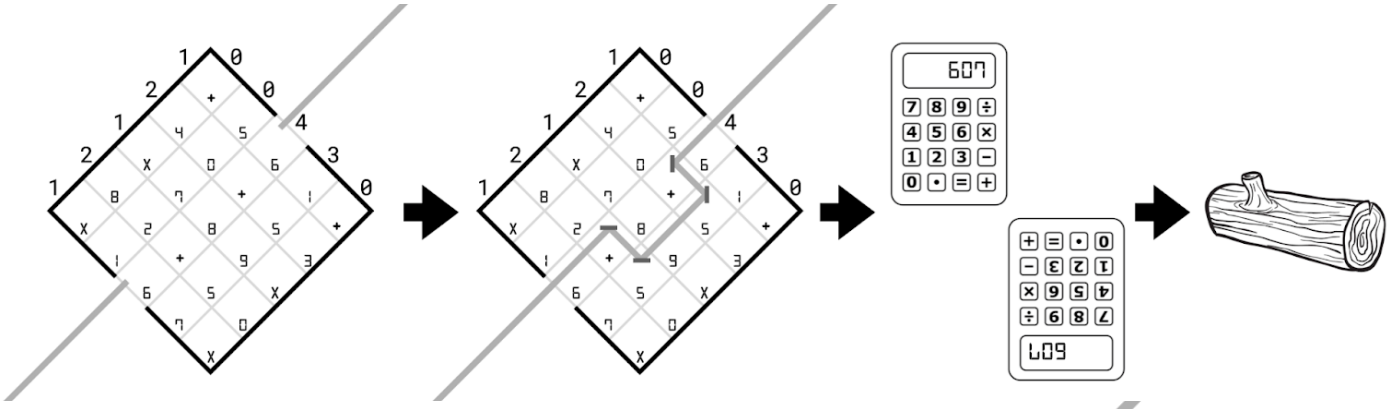
Lasers

Lasers only exist because of Quantum Physics!

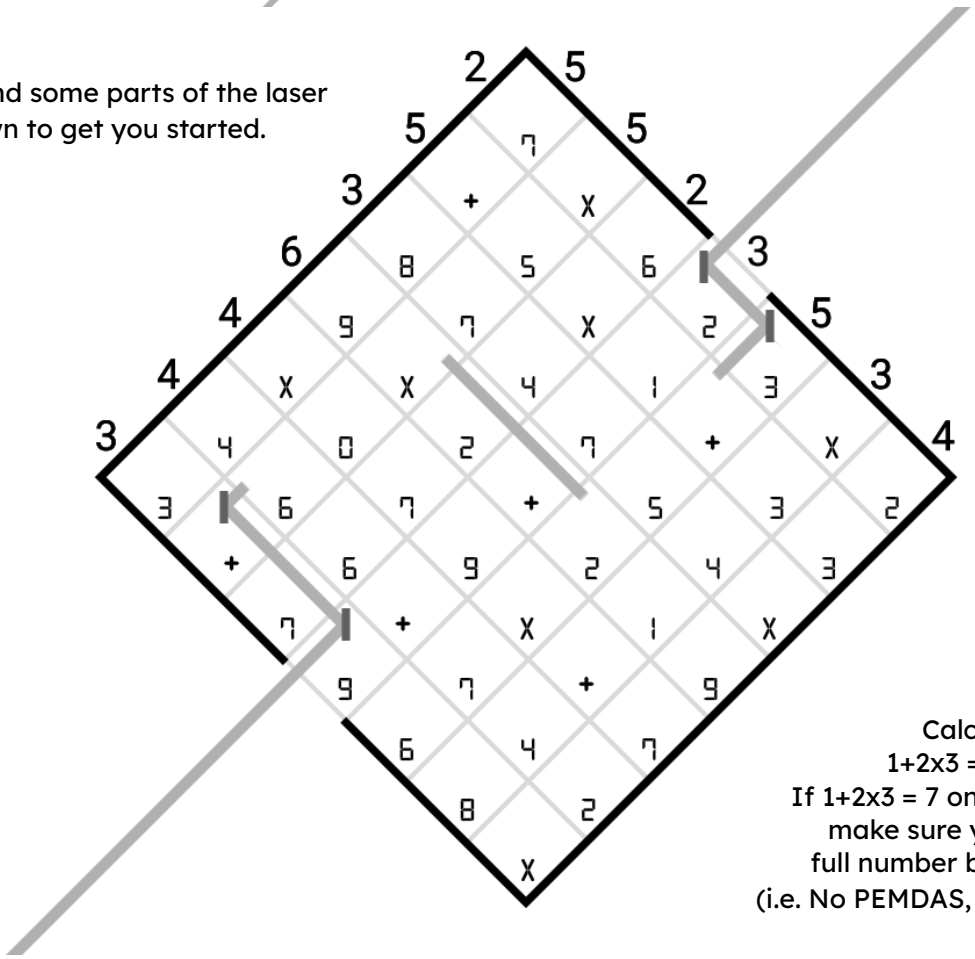
In the large optical chamber shown at the bottom of this page, a laser beam passes through an open port in the chamber walls, reflects off some horizontal and vertical mirrors (0 or 1 per cell), and exits through the other port. The laser beam does not cross itself in the chamber or reflect off of a mirror more than once.

The numbers outside the chamber indicate how many cells in the diagonal column below the number have the laser beam passing through it.

Can you **calculate** the path of the laser beam, **step by step**? The smaller optical chambers immediately below this text provide an example to show you how.



Four mirrors and some parts of the laser beam are shown to get you started.



Calculating step-by-step,
1+2x3 = 9 on old calculators!
If 1+2x3 = 7 on your calculator app,
make sure you hit "=" after each
full number before pressing + or x
(i.e. No PEMDAS, for you mathy folks).

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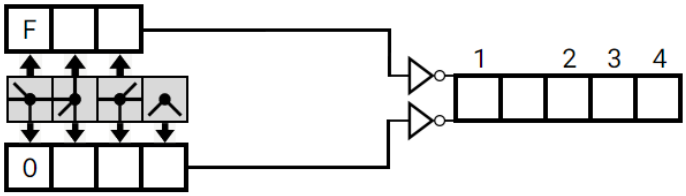
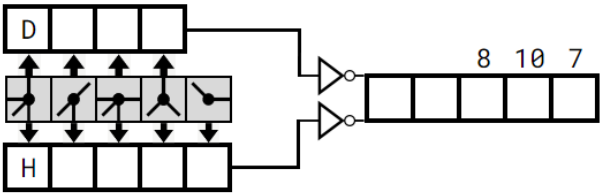
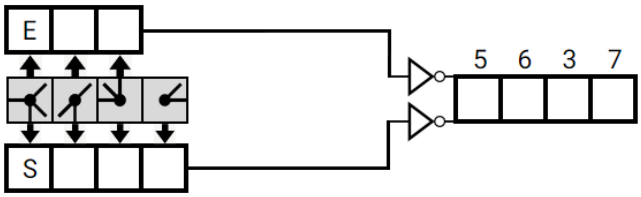
Nuclear Decay and Antiparticles

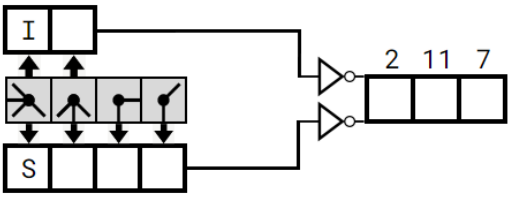
*The Quantum Physicists want to go to their **semi-for**mal holiday party. But before they go, they need to shut down their experimental apparatuses.*

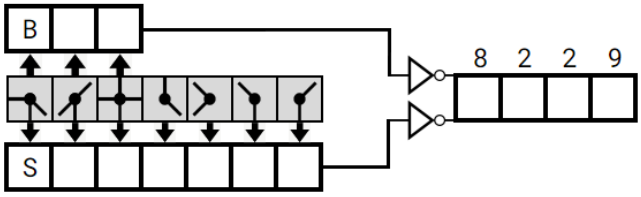
Particles are decaying from atomic nuclei in different directions before being sent through anti-particle generators that output the **opposite** particles of their inputs.

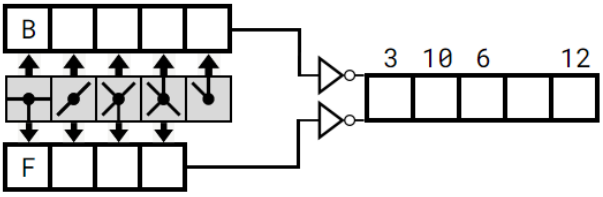


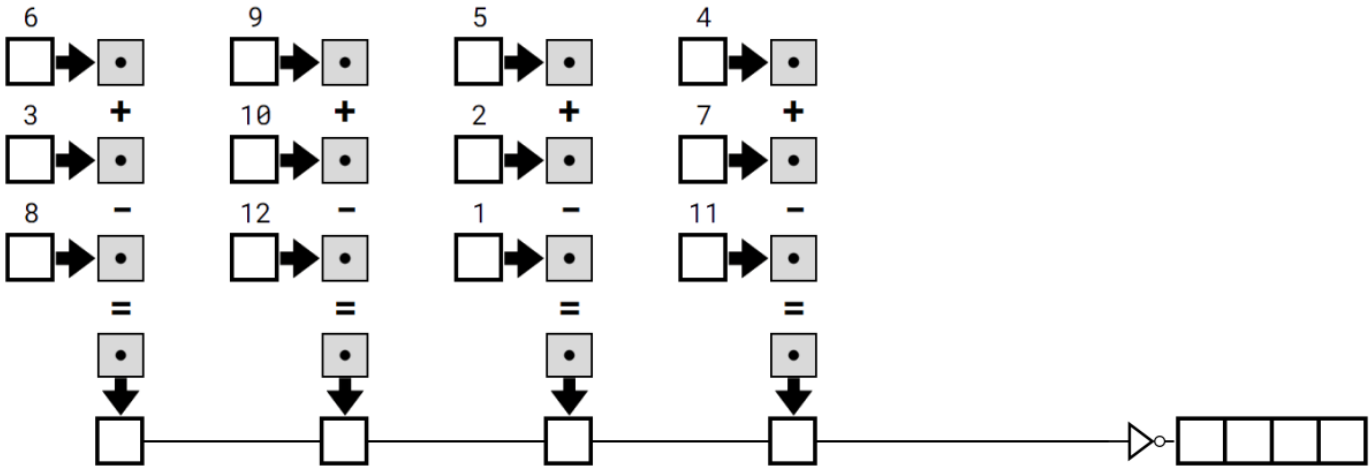












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Many Worlds Interpretation

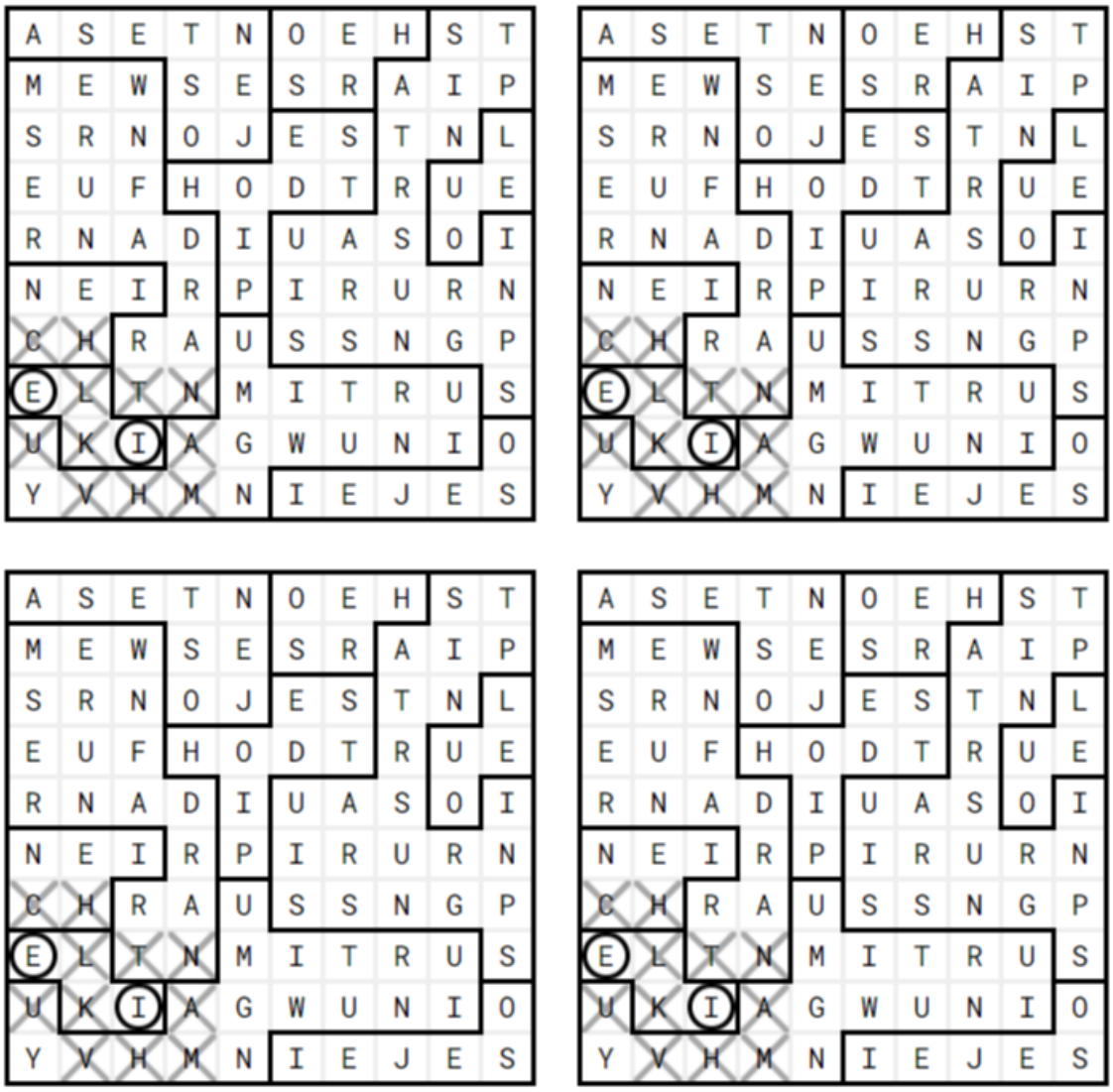
In the Many Worlds Interpretation of Quantum Physics,
you can't be sure which way experiments might turn out in your world…

In the universe below, there are 20 worlds. Each world fits in one grid square. In addition,

- There are exactly two worlds in each row.
- There are exactly two worlds in each column.
- There are exactly two worlds in each area demarcated by black borders.
- No two worlds are in neighboring squares horizontally, vertically, or diagonally.

Four identical copies of the universe are provided, as you may need a few tries.

To get you started, two worlds are shown in each copy of the universe.



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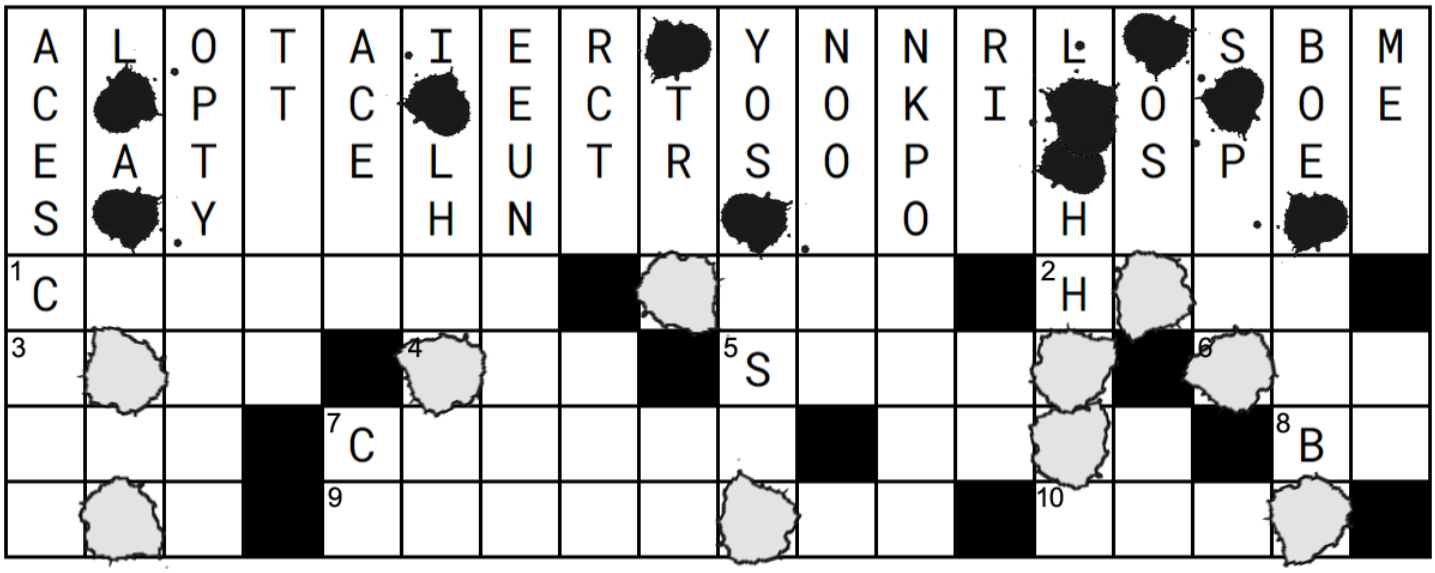
Uncertainty Princip[redacted]

Heisenberg found that we can't precisely know both the position and the speed of a particle at the same time. Sometimes, the best we can do is ***make an educated guess or two…***

1. f[redacted]man of the sea (7 4)
2. what you might find in a politician's speech (4)
3. what you might find on your shirt after you sneeze (4)
4. one of the words in a two word phrase meaning "protrude" (3)
5. sound created by [redacted]breathing (5)
6. word that is [redacted]onym for "attractive" (6)
7. things [redacted]dark red fruit (6 4)
8. nickname one Disney title character might have for the other (5)
9. thing known for being filled with negativity (8)
10. opposite of win (4)



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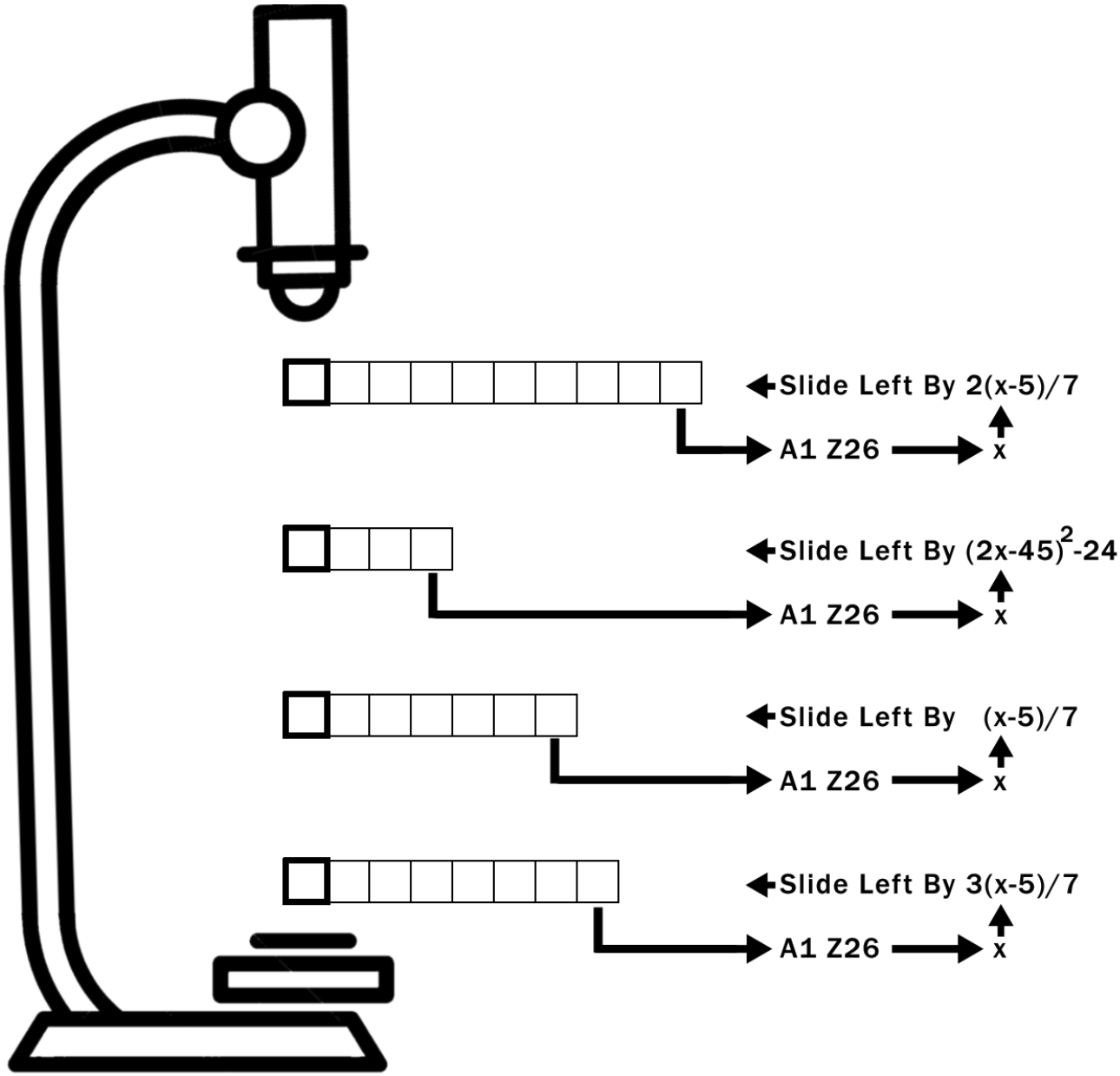
Electron Microscope

META

Check out the electron microscope!
What you see under the eyepiece might be common or obscure!

Make sure you slide your slides over to the left by the correct amount!



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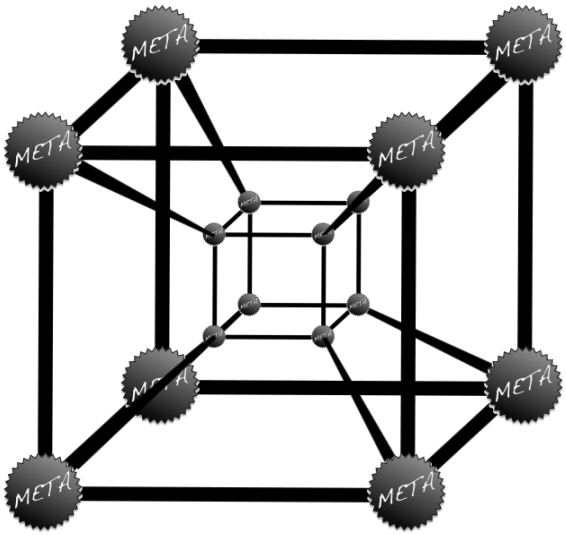
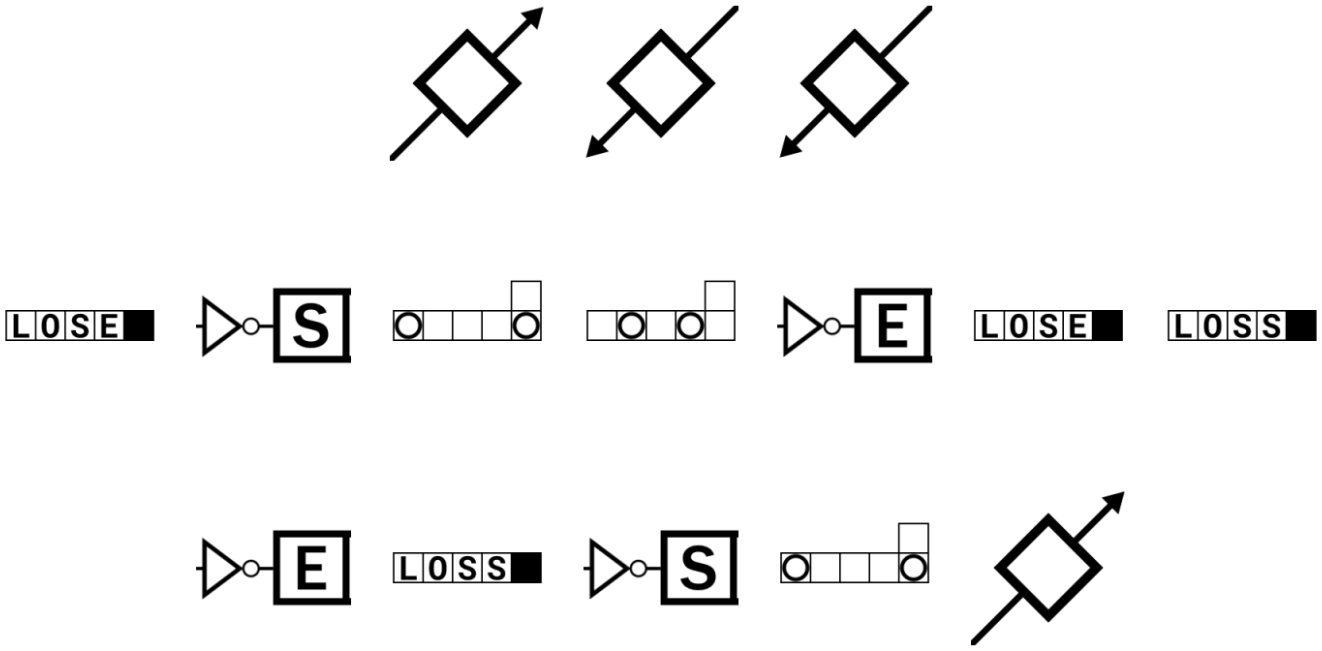


In your world, you solved the Meta and found a 4-letter word for the answer! Congrats!

But in parallel, quantum worlds, a different version of you might have solved each of the first four puzzles a different way and found a completely different 4-letter word for the Meta answer! In fact, there are 16 different possible 4-letter word solutions to the Meta puzzle!!!

Can you work together with all of the different versions of you in the parallel worlds to share all of your answers and use all of them at once to find *the one, single, final Hyper-Meta answer* below, which reveals something you might use an electron microscope to do?



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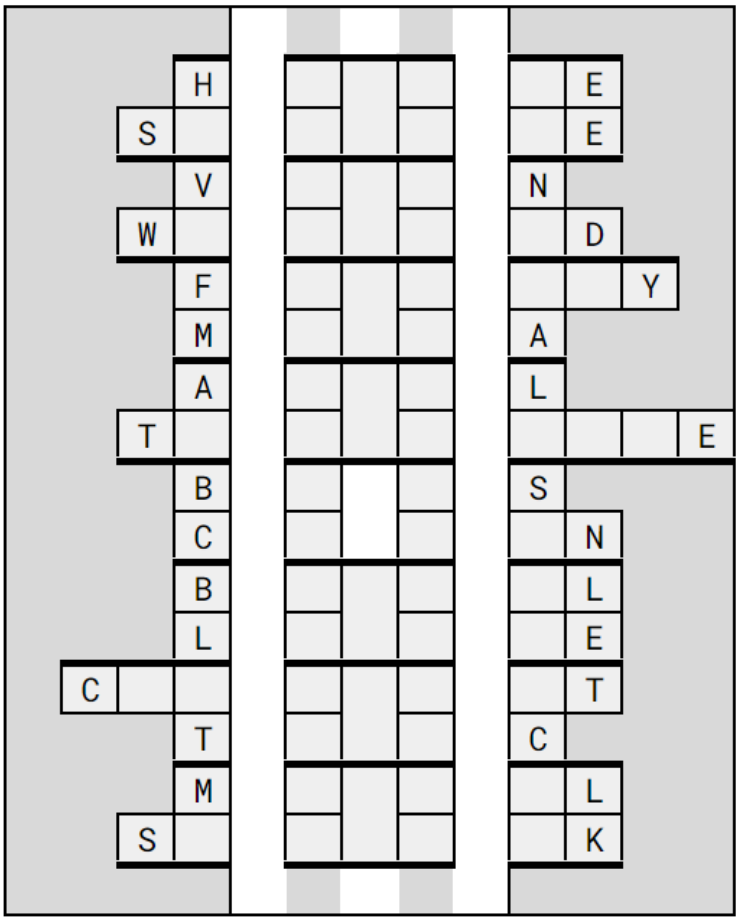
Double-Slit Experiment

BONUS

Photons are emitted and detected like particles. But if light is emitted in front of a screen with two vertical slits, photons are detected behind the screen in an interfering wave-like pattern! And photons are most likely to be detected halfway between the two slits!

I can see through the slits. Maybe you can too?



Bad guy, often seen twirling his mustache

Group of three people sharing power

Hung jury result

It's nothing to cry about

Non-combatant

Painting of fruit, say

Profit seeker

Post sent by plane

Similar to Aslan or Simba

Slope on a small mountain

Small tornado

Taking place in even years, say

They might be itsy bitsy teeny weeny

Type of duty a broker typically has

Unimportant detail

Very large, like a god or ocean liner