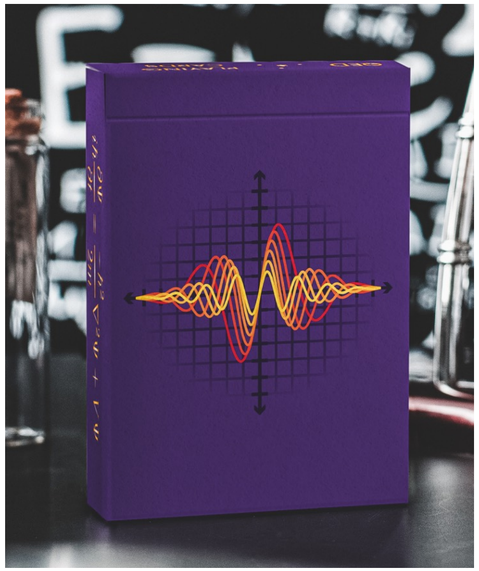
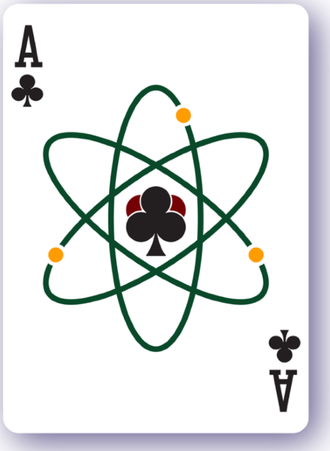
Communicating physics with playing cards

Jason Veatch
Yuko Veatch
University of Göttingen



- Playing cards are common around the world and across cultures
- They are a common medium to share stories and artwork
- QUANTUM playing cards are a unique way to communicate physics and inspire an interest in learning more
- First in a series of decks planned to cover more areas of physics
- Performance and review



Niels Bohr

Ernest Rutherford

Richard Feynman

Max Planck

Lise Meitner

Maria Göppert-Mayer

Marie Curie

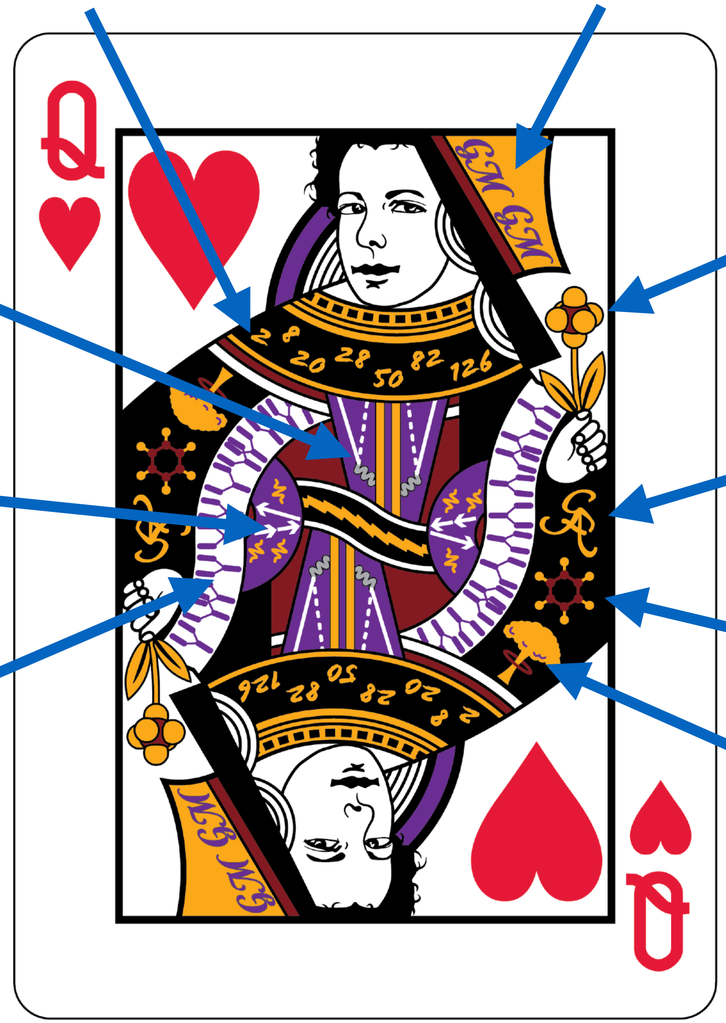
Irène Joliot-Curie

Satyendra Bose

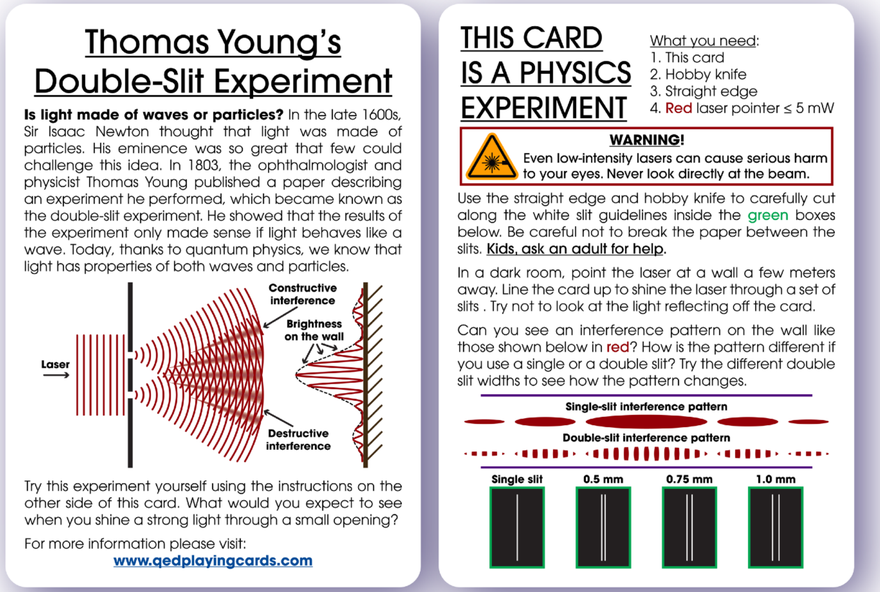
Paul Dirac

Erwin Schrödinger

Werner Heisenberg



Experiment card



Thomas Young's Double-Slit Experiment

Is light made of waves or particles? In the late 1600s, Sir Isaac Newton thought that light was made of particles. His eminence was so great that few could challenge this idea. In 1803, the ophthalmologist and physicist Thomas Young published a paper describing an experiment he performed, which became known as the double-slit experiment. He showed that the results of the experiment only made sense if light behaves like a wave. Today, thanks to quantum physics, we know that light has properties of both waves and particles.

Try this experiment yourself using the instructions on the other side of this card. What would you expect to see when you shine a strong light through a small opening?

For more information please visit:
www.qedplayingcards.com

THIS CARD IS A PHYSICS EXPERIMENT

What you need:
1. This card
2. Hobby knife
3. Straight edge
4. Red laser pointer ≤ 5 mW

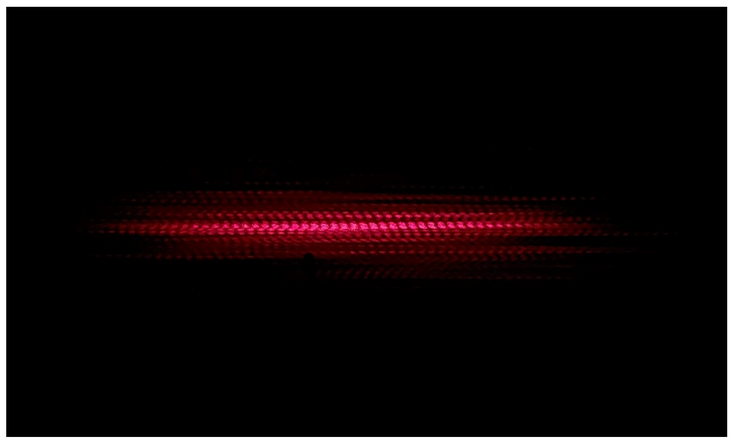
WARNING!
Even low-intensity lasers can cause serious harm to your eyes. Never look directly at the beam.

Use the straight edge and hobby knife to carefully cut along the white slit guidelines inside the green boxes below. Be careful not to break the paper between the slits. Kids, ask an adult for help.

In a dark room, point the laser at a wall a few meters away. Line the card up to shine the laser through a set of slits . Try not to look at the light reflecting off the card.

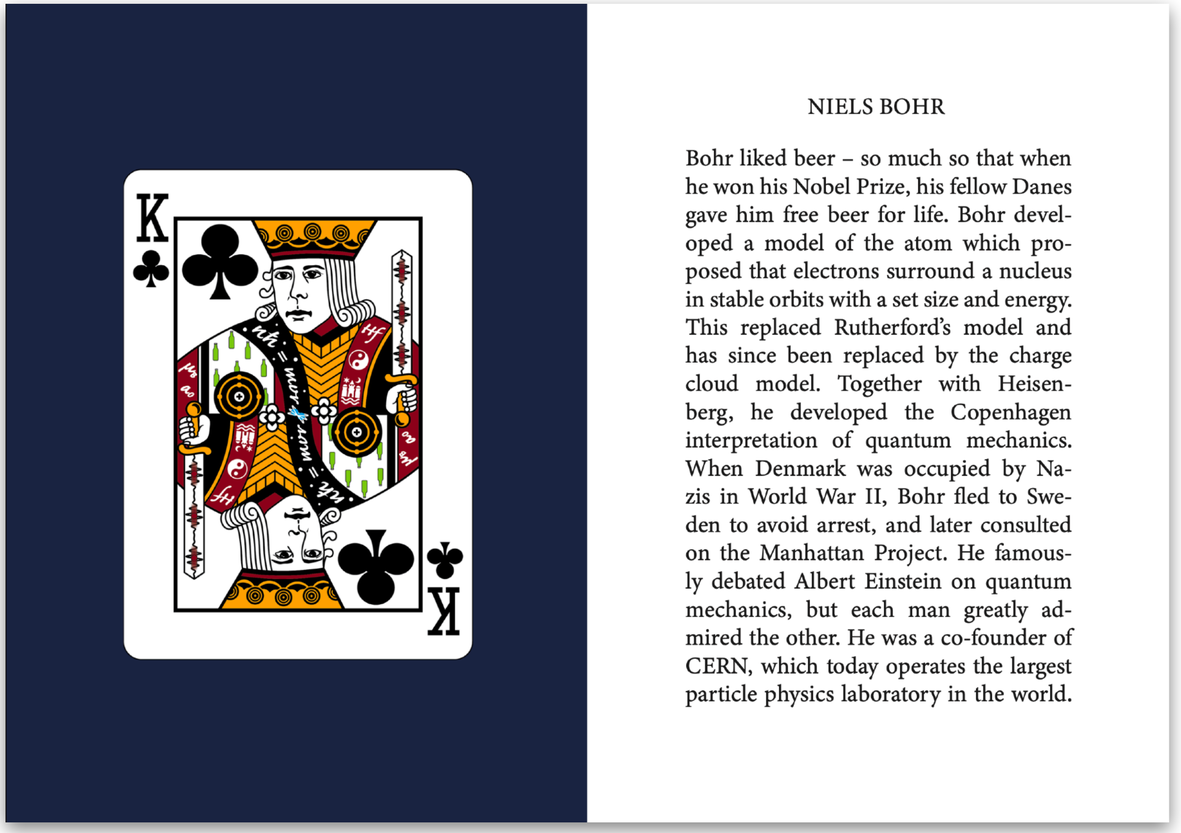
Can you see an interference pattern on the wall like those shown below in red? How is the pattern different if you use a single or a double slit? Try the different double slit widths to see how the pattern changes.

- Includes a card that discusses and gives instructions to perform Thomas Young's double-slit experiment at home
- Works reasonably well using a commercial laser pointer



Accompanying booklet

- An accompanying booklet provides an introduction to quantum mechanics, a brief biography of each physicist, and suggested further reading
- Available online for free here
  - Can be purchased as a printed booklet



NIELS BOHR

Bohr liked beer – so much so that when he won his Nobel Prize, his fellow Danes gave him free beer for life. Bohr developed a model of the atom which proposed that electrons surround a nucleus in stable orbits with a set size and energy. This replaced Rutherford's model and has since been replaced by the charge cloud model. Together with Heisenberg, he developed the Copenhagen interpretation of quantum mechanics. When Denmark was occupied by Nazis in World War II, Bohr fled to Sweden to avoid arrest, and later consulted on the Manhattan Project. He famously debated Albert Einstein on quantum mechanics, but each man greatly admired the other. He was a co-founder of CERN, which today operates the largest particle physics laboratory in the world.

Logistics

- Cards will be printed in Belgium
- Raising production funds with a Kickstarter campaign
  - Campaign will run until July 1st (nearly 300% funded)
  - A single deck costs €10 (plus shipping)
- Can be provided at cost for outreach/education uses
  - Searching for grant options to provide decks for free
- Expected delivery by November 2021

Outreach

- A conversation starter and an inspiration to learn
- Can be used at outreach events (e.g., activity table)
  - Already planned for an upcoming event this fall
  - Other material such as coloring pages, posters, t-shirts and temporary tattoos will also be available
- The project has already provided me with unique outreach opportunities
  - Engaging with card collectors directly about physics
  - Public outreach talks through contacts I've made
  - Kickstarter as a means of offering public outreach talks

- Instagram: @qedplayingcards
- Twitter: @CardsQed
- Facebook: QEDPlayingCards
- Website: www.qedplayingcards.com