

# Interactive Visualisation for Teaching the Quantum Double Slit Experiment

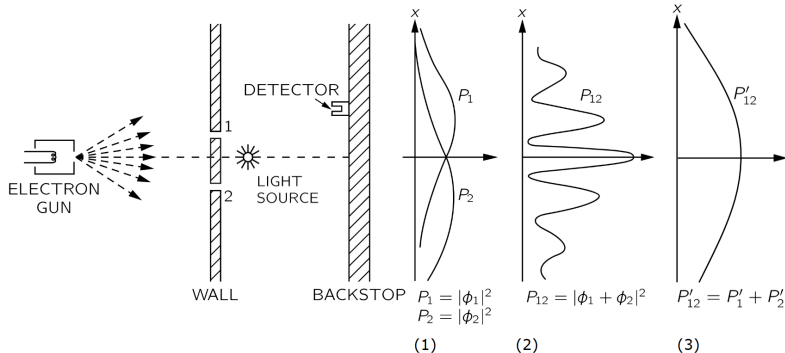
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MPTL 2023

- 1) What is a double slit experiment?
- 2) Existing visualizations
- 3) A new visualization for high school level

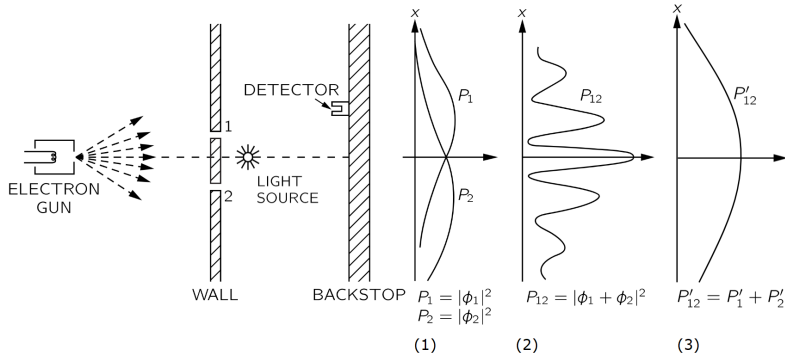
# The Double Slit Experiment



“It has in it the heart of quantum mechanics. In reality, it contains the *only* mystery.”

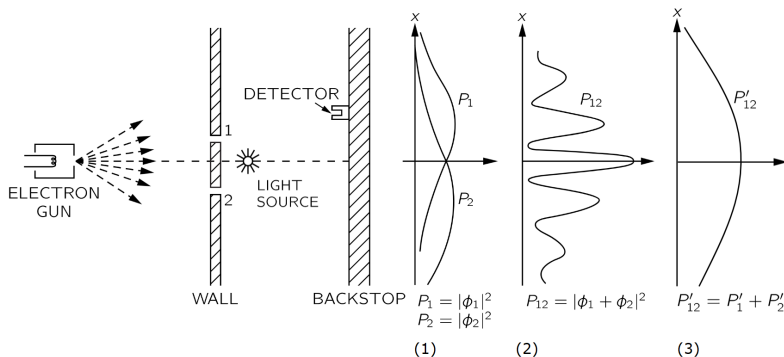
Richard Feynman

# The Double Slit Experiment



- Wave-particle duality
- Superposition
- Measurement

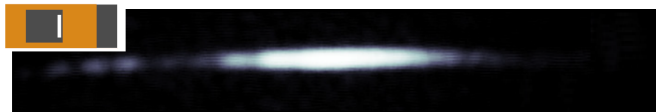
# The Double Slit Experiment



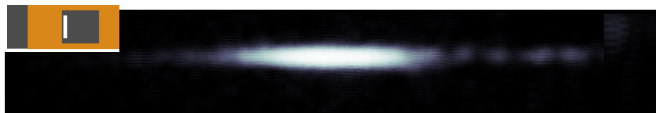
- (1) Slit 1 **OR** slit 2 open
- (2) Both slits open
- (3) Both slits open + detector (light source) active

# The Double Slit Experiment

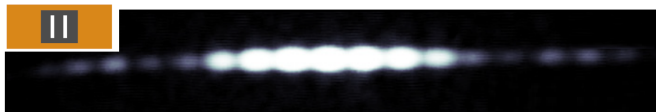
**The real experiment:** 2013, USA (R. Bach, D. Pope, S. Liou)



Left slit open ( $P_1$ )



Right slit open ( $P_2$ )



Both slits open ( $P_{12}$ )

## What are the existing tools for teaching the (quantum) double slit experiment?

- Database (Scopus) and Google search
- Key words: {quantum physics, teaching, visualization, simulation, double slit experiment}
- Annual report of multimedia materials from MPTL 2014

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## Results

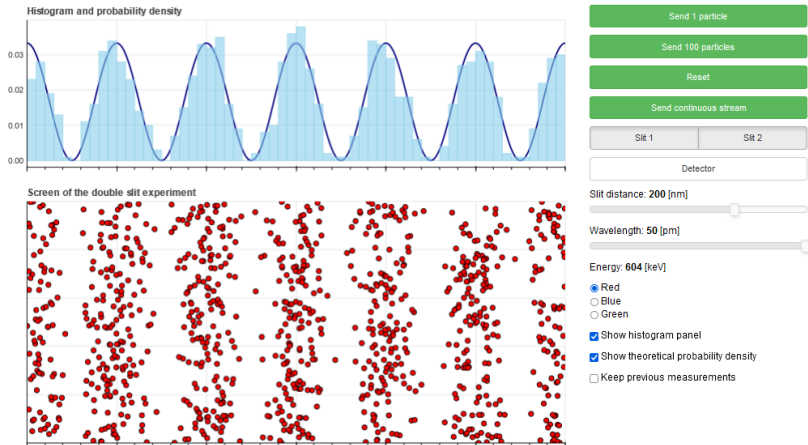
- PhET: *Quantum Wave Interference* (University of Colorado)
- QuILT: *Double Slit Experiment* (Singh, Muthsam *et al.*)
- Dualism (Vícha)





# New Visualization Tool for Teaching DSE

## Double slit experiment with electrons



# New Visualization Tool for Teaching DSE

- Web based (html5)
- Python library Bokeh, javascript callbacks
- Inspired by design principles by PhET
- Interactive parameters (slits set-up, detector, wavelength, ...)



`http://fyzweb.cz/materialy/kvantovka/  
Double\_slit\_experiment.html`

- Development of a teaching sequence on DSE
- Further testing and development within the teaching sequence
- Now: visualization for **electrons** only
- In future: Mode for **classical particles** and **water waves**

Thank you for your attention

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