



# Quantum Eraser Demonstration with a TeachSpin Two-Slit Apparatus

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By

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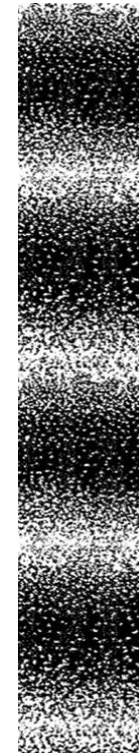
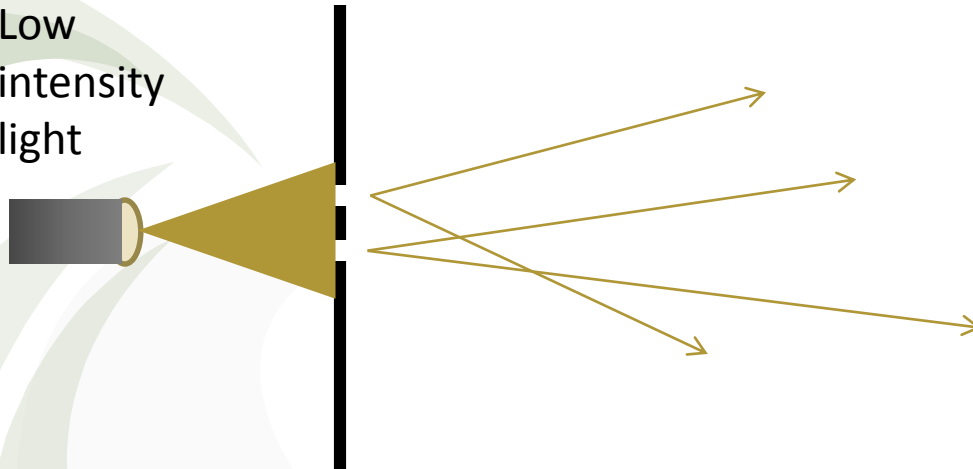
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# Review of Quantum Eraser (QE)

- Young's double slit experiment

$$\text{Fringe spacing} = \lambda L/d$$

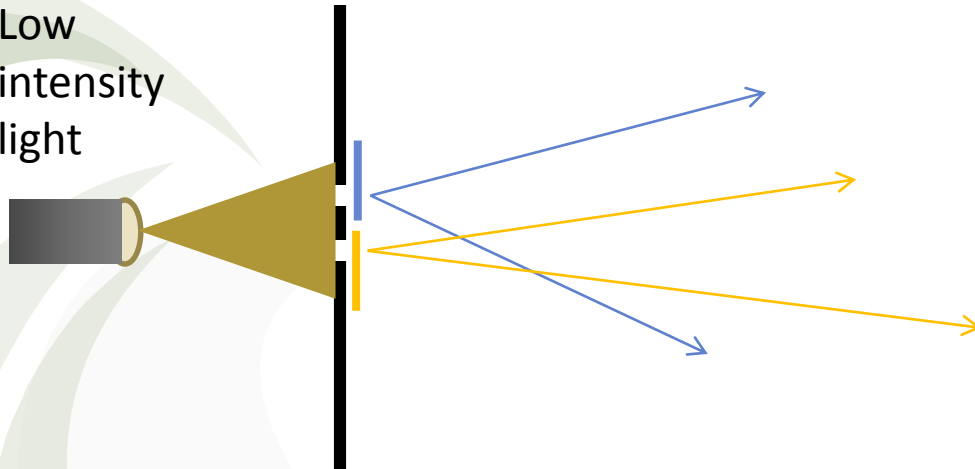
Low  
intensity  
light



# Review of Quantum Eraser (QE) (cont'd)

- Tagging the photons with H and V polarizers
- Interference disappears

Low  
intensity  
light



No Interference

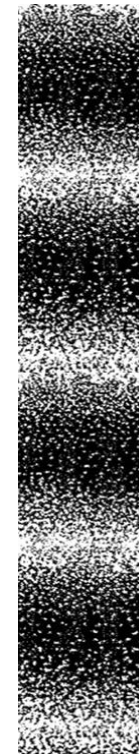
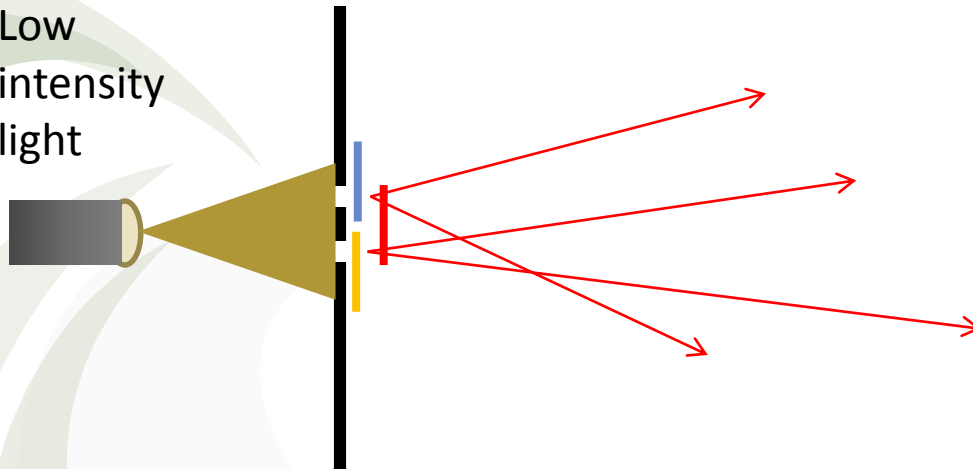


# Review of Quantum Eraser (QE) (cont'd)

- Erase the tags with diagonal polarizer
- Interference reappears

Fringe spacing =  $\lambda L/d$

Low  
intensity  
light

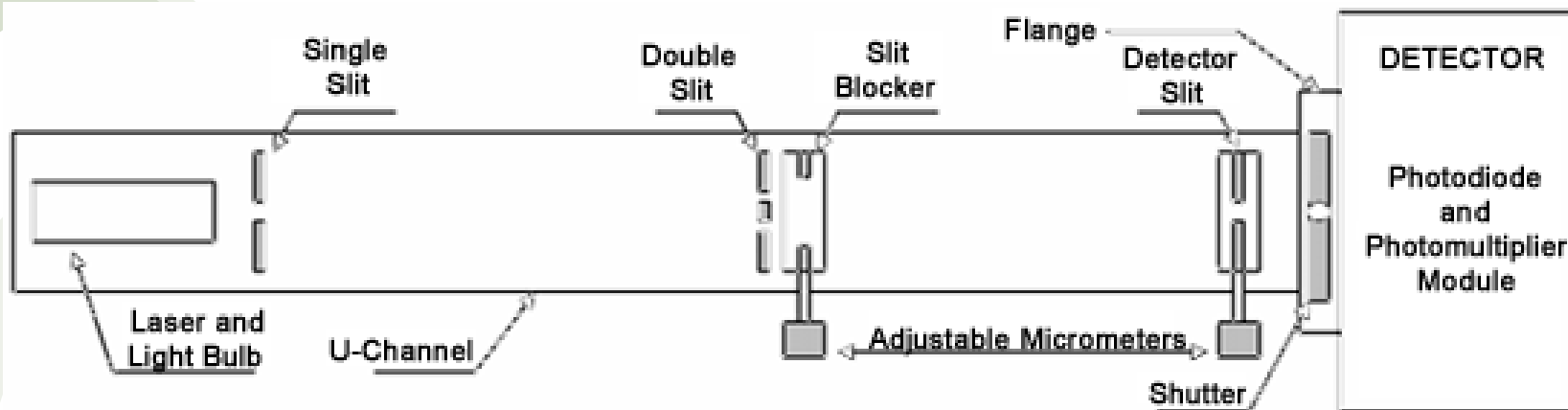
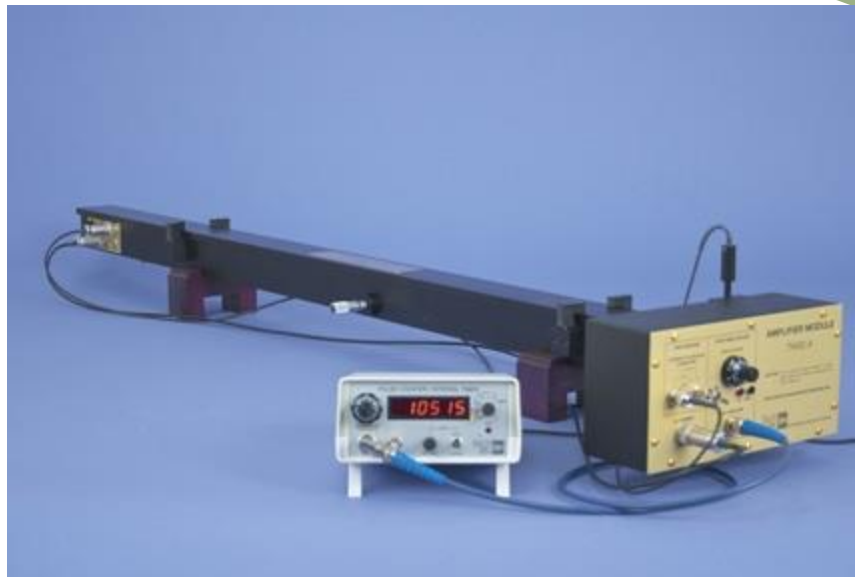


# Some Existing Demonstrations

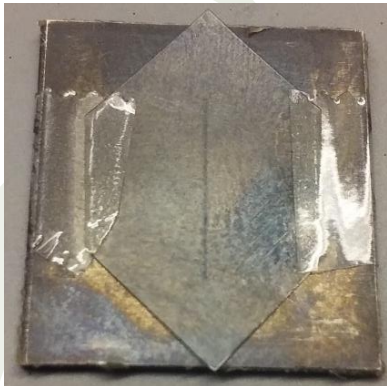
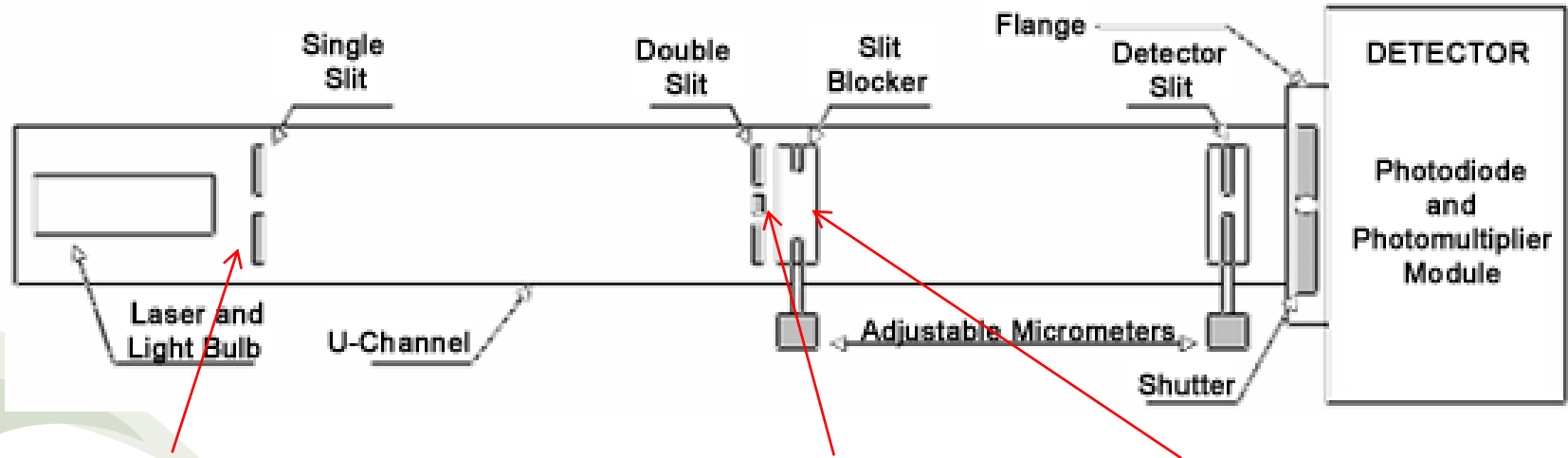
- Classical waves
  - Hillmer, R. and Kwiat, P. (2007), “A do-it-yourself quantum eraser,” *Scientific American*, **296** (5), pp 90 - 95
  - You-Tube videos
- Single photon apparatus
  - Rueckner, W. and Peidle, J. (2013), “Young’s double-slit experiment with single photons and quantum eraser,” *Am. J. Phys.*, **81** (12), pp 951 – 958
  - Schneider, M.B. and LaPuma, I.A. (2002), “A simple experiment for discussAm. J. Phys., **70** (3), pp 266 - 271



# TeachSpin's Two-Slit Apparatus



# Modifications to Make a Quantum Eraser Demonstration



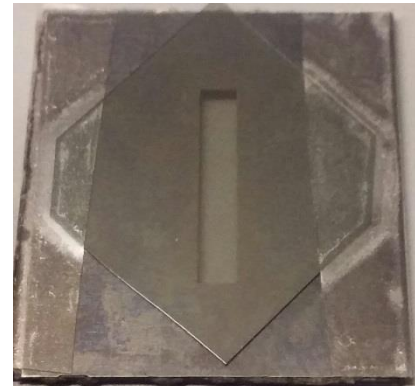
Light Polarizer



Original Slits

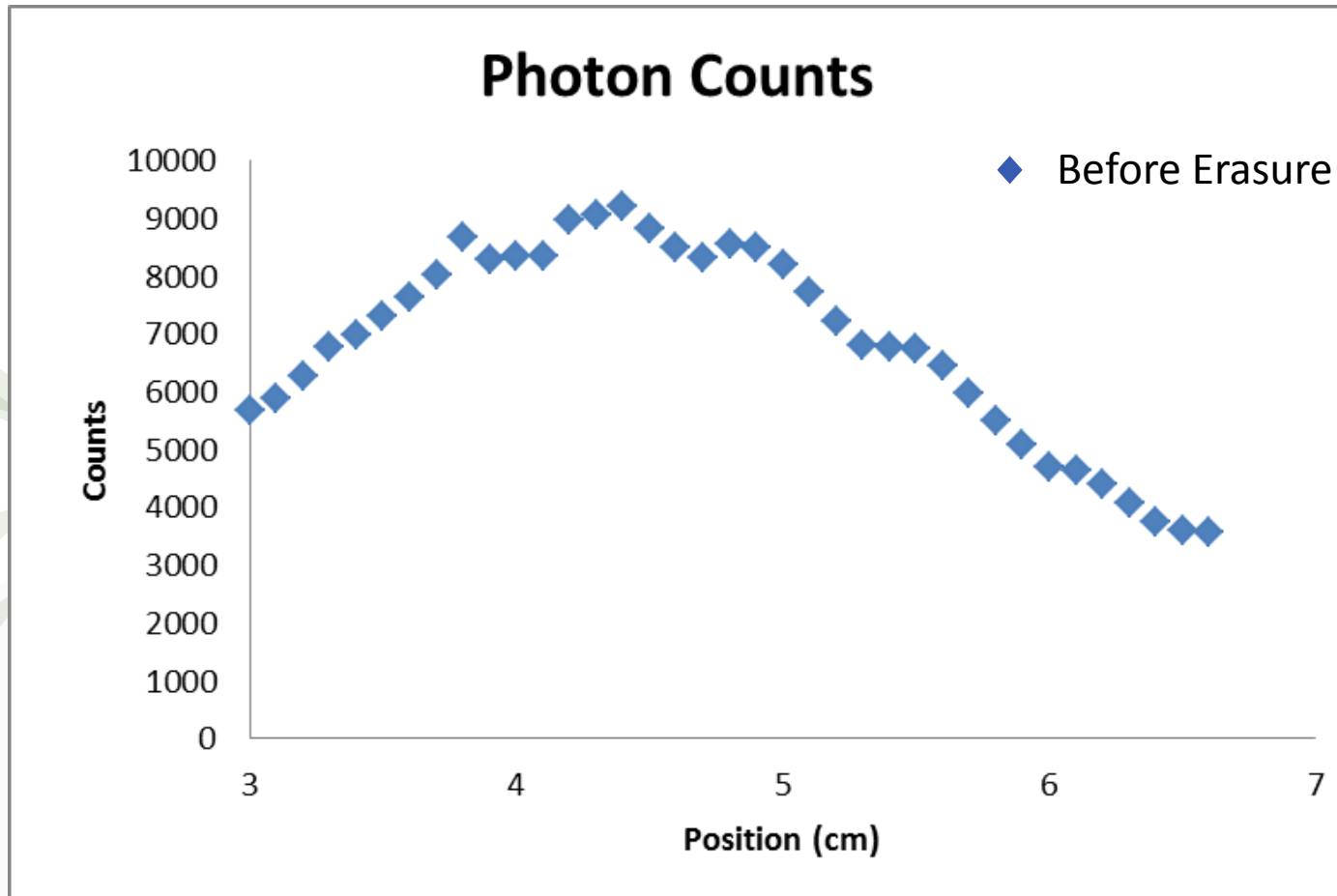


Slits,  $\perp$  Polarizers



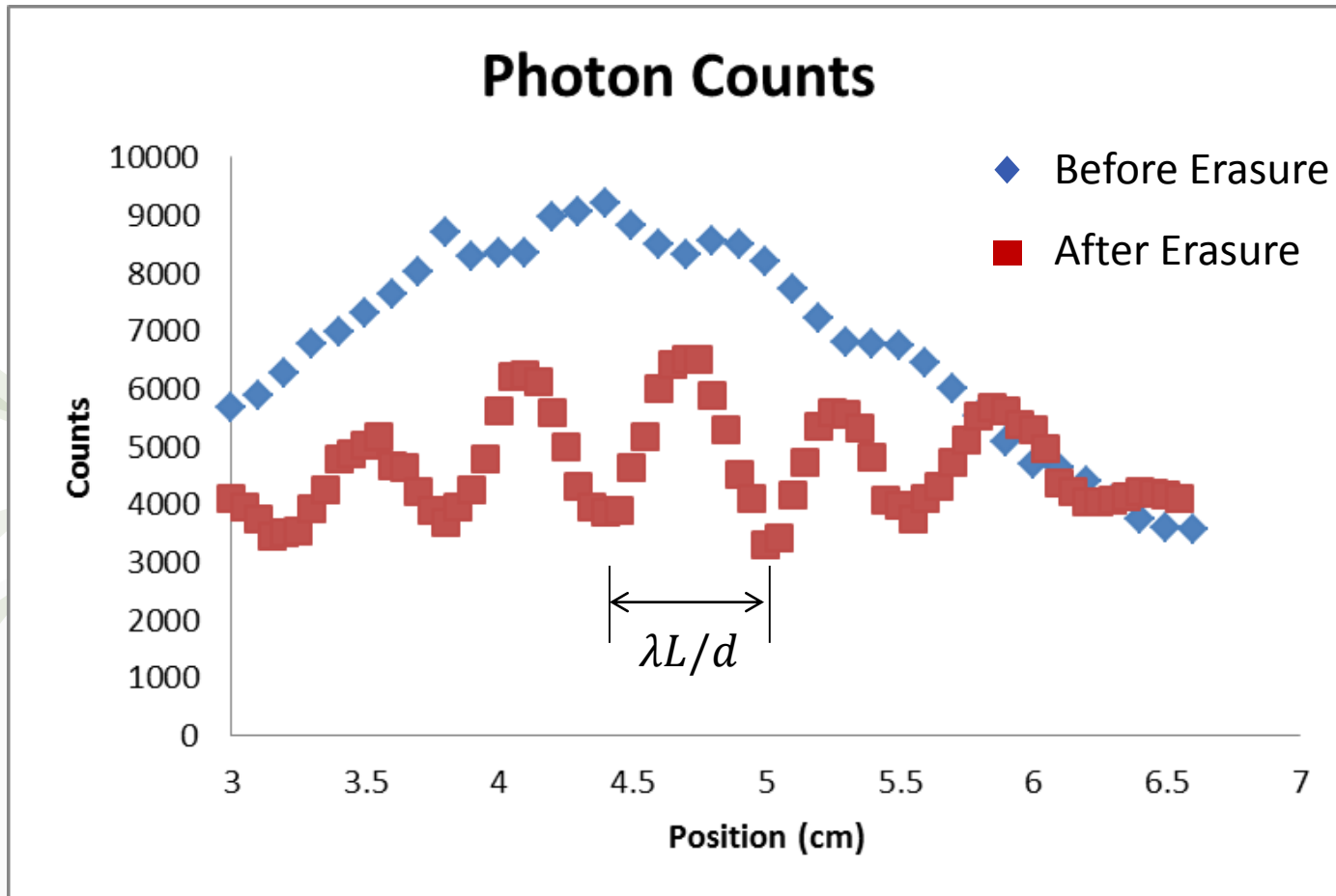
Eraser

# Photon Counts Before Erasure





# Photon Counts After Erasure



# Additional Student Exercise

- Calculate interference pattern for different polarizations of the incoming photons
  - Analysis explains why unpolarized light does not work for QE

