CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
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Project Number
J1626

Project Title
The Case of the Hide and Seek Photons

Abstract

Objectives/Goals
My experiment is trying to demonstrate one of the strange phenomena of quantum mechanics; the dual wave-like or particle-like behavior that a particle (electron or photon) exhibits can depend on what we try to find about it, or the way we measure it. In my experiment, I will use a laser pointer as a source of photons, and a polarizing film to create two pathways for the photons. I will then vary the angles of the polarizer and check what angle of polarization of the polarizing film that a laser light needs to go through, affects and erases the information about which side the light photons used.

Methods/Materials
I used a laser pointer six feet from a wall in a very dark room, polarized film for labeler (that will indicate which path the photons took) as well as a straightened staple that I attached to the path labeler. I placed the wire vertically and centered in the light and I observed that light will create an interference pattern. When I used the path labeler the fringes of interference were gone; the left hand polarizer produced vertically polarized light and the right hand one produced horizontally polarized light. I used another polarizer in between the wall and the labeler and I modified the angle: vertical and horizontal orientation, 45, 22.5 degrees, diagonal and vertical labeler, diagonal and horizontal labeler.

Results
When using the polarizer with the vertical orientation all the right passing photons that became horizontally polarized are blocked and there will be a bigger concentration of photons on the left of the screen .The spot on the wall when using the polarizer with horizontal orientation extended to the right. For the diagonal polarizers 45 and 135 degrees, I notice interference fringes looking as if the polarizer erases the information about which side the photons went and that each photon went both sides and interfered with itself.

Conclusions/Discussion
The probability to obtain perfect fringes of interference is small since light can also be unpolarized meaning that some of the photons will have random polarizations and only part of them will get through the polarizer. I would like to continue to investigate the possibility of restoration of the fringes of interference by further modifying the orientation of the analyzer and path labeler, the distances between the path labeler, analyzer and screen and to use a thinner wire for a clearer view of the interference pattern.

Summary Statement
Demonstrating the dual behavior of photons as particles and waves;studying the possibility of creating perfect fringes of interference.

Help Received
Mom and Dad advised me and helped me purchase the optical stand and polarizing film from Edmund Scientifics and setting up the camera. My science teacher from Medea Creek Middle School Mr. Troy Labnow helped with editing.