MAR15-2014-005339

Abstract for an Invited Paper
for the MAR15 Meeting of
the American Physical Society

A hands-on introduction to quantum mechanics[1]

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At Dickinson College, we have implemented a series of experiments that are designed to expose students to the strange and fascinating world of quantum mechanics. These experiments are employed in our sophomore-level course titled *Introduction to Relativistic and Quantum Physics*, our version of the traditional *Modern Physics* course. The experiments make use of a correlated light source produced via the process of Spontaneous Parametric Down Conversion (SPDC). Using such a light source, students can experimentally verify that when a single photon is incident on a beam splitter, the photon is either transmitted or reflected—it *never* goes both ways. If instead the photons are directed into a Mach-Zehnder interferometer, students then observe an interference pattern, suggesting that each photon must somehow take *both* paths in the interferometer (in apparent contradiction of the first experiment). Finally, the interference pattern is observed to disappear if the photons are "tagged" to distinguish which path they take, only to mysteriously reappear if that path information is "erased" after emerging from the interferometer. In this talk, I will provide an overview of these experiments and the accompanying theory that students learn in this course.

[1]This work was supported, in part, by NSF grant 0737230.