Abstract Submitted
for the PSF13 Meeting of
The American Physical Society

Development of quantum mechanics laboratory for undergraduate teaching[1] HARRISON KNOLL, PAUL MICELI, PING YU, Univ of Missouri - Columbia — We present our recent development of a quantum mechanics laboratory for undergraduate instruction. The experiments are based on detecting entangled photon pairs from the spontaneous down conversion in a beta-barium borate (BBO) crystal using low level light detection techniques. We address two issues in this work: (1) a demonstration of low level light detection by using a sensitive CCD camera to show the down conversion photon pairs from the BBO crystal and the statistics of photons in a slow time scale. (2) Experiments to show the transitions from classical states, semi-classical states, and quantum states. The wave nature of light is described by Maxwell's equations of electromagnetic fields as well as classical statistics. The construction of a Hanbury-Brown and Twiss interferometer gives an opportunity to examine wave nature of light in non-classical statistics. The quantum nature of light, proposed by Einstein, has been used to explain the phenomena of the photoelectric effect. A detection of second-order correlation for photons through a beam-splitter using their entangled photons as a gate provides experimental proof of quantum nature of photons. We offer this laboratory for the first time in the Department of Physics and Astronomy, University of Missouri during the fall semester 2013.

[1]This work was supported by the research incentive grants from the Arts and Science Alumni Organization at the University of Missouri.

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Date submitted: 13 Oct 2013 Electronic form version 1.4