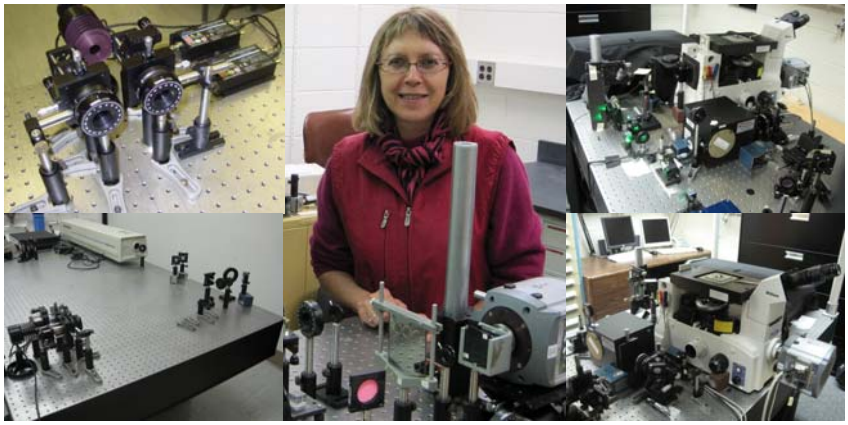
ALPHA LABORATORY IMMERSION

The Institute of Optics, University of Rochester, 8/18 – 8/20/2010 – 2 Set Ups

(1) ENTANGLEMENT AND BELL's INEQUALITIES, (2) SINGLE-PHOTON SOURCE



Description:

As much as wireless communication has impacted daily life already, the abstract theory of quantum mechanics promises solutions to a series of problems with similar impact on the twenty-first century. Quantum computers will have enormous capabilities and quantum communication with single (antibunched) or entangled photons will provide absolute encryption security to any message. Entanglement is the most exciting and mysterious concept in quantum mechanics. Bell's inequality violation proves nonlocality in the measurement process.

This workshop will teach how to generate and characterize single and entangled photons using modern photon counting instrumentation, e.g., single photon counting detectors SPCM-14, low-light level EM-CCD camera iXon, PCI board TimeHarp 200 for time-correlated single-photon counting, etc. This instrumentation is also widely used in nanophotonics and biomedical research. Polarization entangled photons will be obtained using the spontaneous parametric down conversion process (left photos). The single-photon source lab (right photos) consists of confocal fluorescence microscopy of single emitters and antibunching measurements using a Hunbury Brown and Twiss interferometer. All participants will carry out both labs. The lab manuals (see Lab 1 and Labs. 3-4), lectures and student reports are placed on the website of my course "Quantum Optics and Quantum Information Laboratory" http://www.optics.rochester.edu/workgroups/lukishova/QuantumOpticsLab/. Participants need to bring a lab notebook, USB flash memory stick, and a digital photocamera.

Mentors – Bio (Include Picture)

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B.S./M.S. with honor (1973) and Ph.D. degrees (1977) from the Moscow Institute of Physics and Technology (FizTech). My Ph.D. was co-supervised by Nobel Prize winner A.M. Prokhorov. M.S. and Ph.D. works were done at the P.N. Lebedev Physical Institute of the USSR Academy of Sciences. After holding research positions at the USSR/Russian Academy of Sciences, I moved to US in 1997. I have nearly 40-year-experience with interaction of laser radiation with matter (over 190 publications including co-editing Springer book). I am also topical editor of Optics Letters. Currently my main research areas are photonic quantum information systems, nanophotonics, nonlinear and coherent optics.

I've been teaching and developing this lab course supported by three NSF grants since 2006. A series of modular 3-hour experiments and 20-min-demonstrations based on technical elective, 4-credit-hour lab course were incorporated into a number of courses ranging from freshman to senior level. Monroe Community College students are also carried out two 3-hour labs at the University of Rochester.