

Personal Essay for Nathan Lemke

I intend to study optics or laser/atomic physics at Colorado. My experiences in this field includes research at NIST (Boulder) in the Time and Frequency Division, interning with Honeywell Aerospace in the Ring Laser Gyro Design Engineering group, and research done at Bethel with Dr. Richard Peterson, both in class and over the summer.

My work at NIST during the summer of 2005 was with the Student Undergraduate Research Fellowship program. I worked in Dr. Leo Hollberg's group, known as the Optical Standards Group, building an optical atomic clock based on laser-cooled Ytterbium atoms. My part of this large project was to frequency-characterize and -stabilize the laser that will serve as the local oscillator in the clock. Through this summer research, I gained much experience working with laser-cooling and trapping, laser linewidth measurements, feedback stabilization methods, and general optics and physics lab skills. Additionally, the summer showed me what physics research looks like in a professional research lab, and energized me to pursue research in graduate school.

I spent my junior year (including one summer) working at Honeywell in Minneapolis with the ring laser gyro design team. My role was with the life team, working to design a longer-lived laser. Some of my duties included basic intern tasks (data acquisition and presentation) but many of them allowed me to get into the lab to conduct my own experiments. The most significant project I conducted was to monitor the spontaneous emission of the laser as a function of run current and gas mix ratio. While at Honeywell, I was able to learn about laser physics, develop skills of data interpolation and presentation, learn about working in an applied physics industry, and improve my oral communication skills by giving talks to teams of scientists and engineers about my projects. I left Honeywell to pursue my fellowship at NIST.

I have taken two courses at Bethel in my chosen field: Optics and Lasers. In the traditional Optics course, my semester-long project involved heterodyne interferometry of an expansion tube (or "ping-pong cannon"). The interferometer was used to track the rapid pressure change as a function of time near the end of the tube. Some of the work done in this course led to a month-long summer project that I was involved in, and it included such things as pulsed-Schlieren photography of the same expansion tube. In addition to these projects, I also performed a shorter project dealing with time-average holography of a resonating organ pipe. In the Lasers course, my project involved taking high-speed photographs and shadowgraph images of moving bullets with a pulsed-dye laser as the light source. Other lab exercises in this course included aligning the mirrors on a homemade Helium-Neon laser and using a scanning Fabry-Perot cavity to diagnose the mode spacing and fast linewidth of a laser.

My plans for grad school are to pursue a Ph.D. in optics or atomic physics. Initially, I would welcome a teaching assistantship (I have served as an undergraduate teaching assistant at Bethel for 3 years), but ultimately I would like to find an interesting research project, and there are plenty such projects at CU that I think are very fascinating. My career goals are, like many individuals', a bit uncertain. I do have an interest in working with students as a teacher, but I have a greater interest in working in research, especially in an applied physics industry. Thus, I have chosen to pursue the industrial researcher track for now, and optics is my industry.

Thank you for considering my application.