

Physics Department Senior Design Project Proposal

Project Mentor: Tom Furtak, x3843, tfurtak@mines.edu

Project Title: Raman Spectrometer Instrumentation

Project Type: [] Team; Number of students: 2 [] Honors

Objective

The Raman effect involves inelastic scattering of light from a laser. The energy shift is directly related to the energy of elementary excitations in the sample. Raman scattering is most commonly used to assay vibrational modes in molecular systems. Recently, Raman scattering has been used to study nanostructures. Raman instrumentation involves a high-resolution double grating spectrometer, which enables separation of the very weak Raman light from strong elastic scattering of the incoming laser light. This project involves converting an existing Raman spectrometer to run under computer control.

Prior Background

The spectrometer is a Spex 1403, which currently operates with an older, dedicated controller. All of the technical manuals for this system are available, or can be obtained. Our group has extensive experience with high-resolution spectroscopy of this type.

Student Expectations

Students will configure a simple digital IO board for use with the spectrometer. They will design a LabView VI that works with the board. The routine must operate the spectrometer's stepping motor driver, and acquire photon-counting data from the existing pulse-filtering electronics that are coupled to a high-sensitivity photomultiplier. The project should lead to a working control system with an intuitive user interface by the end of the semester, including demonstration of the operation by a successfully measured Raman spectrum of an ionic salt.

Supervision Plan

Day to day supervision will be coordinated with a senior grad student. Students will meet as a team with Prof. Furtak once a week.

Resources

All necessary hardware is in place. Expendables will be provided by the Senior Design materials budget.

Technical References

B. C. Chow, T. T. Ehler, and T. E. Furtak, "High-resolution sum-frequency generation from alkylsiloxane monolayers", *Applied Physics* **B 74**, 395 (2002).

D. M. Burger, "The design and implementation of a computer interface for a Raman spectrometer using the LabVIEW software package," *Vanderbilt Undergraduate Research Journal* **4**, 1 (2008).