Introduction to Scientific Instrumentation
Phys 232, Winter 2021
Instructor: Prof. G. Seidler, seidler@uw.edu

3 credits, remote-only offering
Prerequisites: PHYS123, PHYS334
Enrollment limit: 25
Can be substituted for senior lab requirement

The design and use of scientific instrumentation is central to the mission of the physical and biological sciences. This involves a journey starting with project definition and then traveling through instrument design, iterative improvement, user interface optimization, experiment design, data collection, and statistical analysis, to finally reach conclusion. The purpose of this class is to give an introduction to this process with an emphasis on building core skills in software, computer integration with microprocessor automation, data collection, data analysis and statistics, and hands-on experience with the construction and improvement of apparatus.

The first offering of this class will therefore split time between several major components. First, we will emphasize instruction in the Python environment, touching on each of basic programming skills, data presentation, and statistical analysis, all using standard Python classes and libraries. Second, this will be a 'flipped lab' where every student will have, in their home study space, their own Arduino microprocessor and associated components needed to implement a transmission spectrophotometer or optical fluorescence spectrometer while using the Python environment to interface the microprocessor via USB port. Third, the students will gain strong skills in data reduction and graphical presentation, enabling effective presentation of experimental results, including (virtual) in-class presentation. The major class project for each student or small collaborative pod will be the iterative development, testing, and application of their spectrometer including its integration with the Python environment to achieve both a complete user interface for data collection and also a well-documented analysis pipeline for data analysis and presentation of results.

Grading will be based on homework (70%) and the final course project (30%).

Notes:

1) Students will need to have access to a relatively modern computer with a standard operating system allowing installation of *conda*, *Jupyter*, and *pyFirmata*. Students are strongly urged to investigate these constraints well before the Winter 2021 quarter starts.
2) There will be a $50 lab fee, which will cover the Arduino board and all other course-relevant components (such as for the photometer). A 'kit' style package will be delivered to each enrolled student. If delivery of such a package will be complicated by customs requirements, please contact the instructor during the Autumn 2020 term.