

Measuring the Mass of the Milky Way: Converting a 350 PHYS Project into a 250 Lab

Tuesday, 24 August 2021 13:15 (15 minutes)

Every year the PHYS 350 students design and run an experiment themselves. It is usually disassembled soon after, but this year, we wanted to give the second-year students a look at what they could be doing in their next year, as well as providing them a chance to do an astronomy-based experiment in PHYS 250. We choose an experiment on measuring the mass of the Milky Way that published their paper on the topic. This lab allows the second-year students to learn basic astronomy practices as well as data analysis and critical reading in scientific settings.

Currently, in PHYS 250 all students are given a list of 3-hour experiments to choose from. This new Milky Way experiment will be an option for two groups in tandem. We split the lab into two weeks so there is more time for planning and completing the experiment.

The main objective for this lab is to measure radio frequencies coming off hydrogen clouds in the bands of the Milky Way, and through rotation calculations and Doppler effect, determine the size and mass of the Milky Way. Most of the equipment needed for this experiment was built by the PHYS 350 students in 2020-21, but the code for the GNU radio was modified to create a binary file output of any signal data gathered from the antenna. This new code made the error analysis much quicker and simpler. Data can now be analyzed in any Python environment by converting the binary to a numpy array and then performing needed calculations.

We conducted a mock lab by running the experiment with different members of our group with varying physics and coding backgrounds. We were able to create a question plan that would lead students in the right direction for their observations while also making sure they employ critical thinking and research skills. In the first week the students will run through various questions about astronomy and how the environment will affect their data as well as planning their observations for the next week with the hardware they want to use. The next week they will be able to perform their signal measurements as well as begin their data analysis.

Primary author: MAST, Madelynn (Queen's University)

Presenter: MAST, Madelynn (Queen's University)

Session Classification: Session 6