Dr. Michael H. Wood
Chair, Department of Physics
Canisius College
February 15, 2019

Laser Request

Undergraduate laboratory experiments on special relativity are rare compared to other topics like Newtonian Mechanics, Thermodynamics, and Electricity/Magnetism. An example of a popular experiment in special relativity is the lifetime of the muon from cosmic rays. To perform it, the students need some particle physics equipment like scintillator counters, photomultiplier tubes, and a data acquisition system. From that measurement, one can infer time dilations. Another standard measurement is the speed of light using a laser and a long length of fiber optic cable. Beyond these, there is not much available at the undergraduate level. What is needed is more experiments involving light and the concepts of relative motion.

Recently, I found such an experiment. It is the "Fizeau's aether drag" experiment[1]. The experiment is a variation of an interferometer. A laser beam is split, and one beam travels through water in the direction of the current and the other beam travels against the current. When the two beams are combined, an interference pattern is formed. The pattern can be analyzed to extract the relative motion. The results are compared to Galilean relativity and Einstein's special relativity. The data match the special relativistic predictions more closely.

I am the chair of the Department of Physics at Canisius College, a primarily undergraduate institution in Buffalo, NY. I am interested in reproducing this experiment. The department has most of the equipment like an old optical table and some mirrors that were once used by a now retired faculty member. To get started on the project, I am requesting one of your free lasers. My department is willing to pay for the shipping costs.

---

[1] T. Lahaye, P. Labastie and R. Mathevet, "Fizeau's *aether-drag* experiment in the undergraduate laboratory", Am. J. Phys., 80, pp. 497–505 (2012).

https://www.spiedigitallibrary.org/conference-proceedings-of-spie/9793/97931G/Fizeaus-aether-drag-experiment-in-the-undergraduate-laboratory/10.1117/12.2223112.full?SSO=1