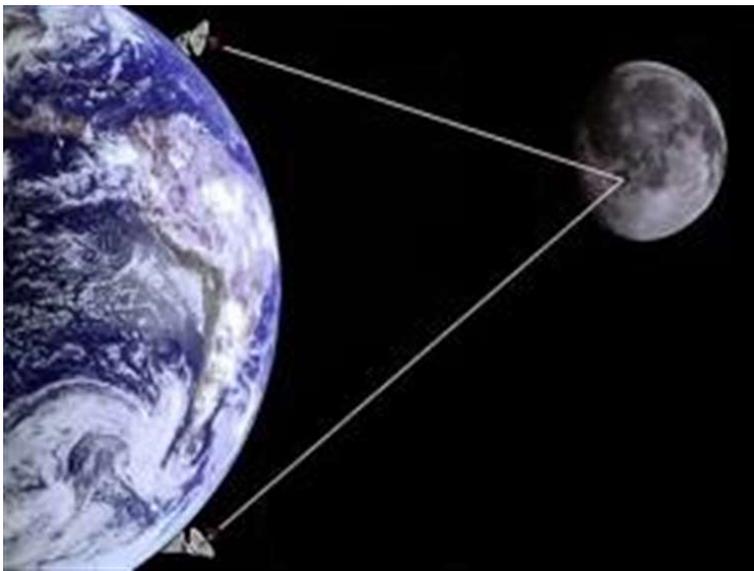


New class: Ph / APh / EE 118c - coming in Spring 2025

**Physics of Measurement: Moonbounce and beyond -
Microwave interferometry and scattering for metrology & communications.**

9 units (3-0-6); third term. Prerequisites: Ph 118a, and a course in microwave physics or engineering (e.g., Ph 118b, EE 153, or equivalent), or permission from the instructor.

In 1944, the possibility of bouncing radio waves off the moon was first discovered inadvertently. Since then, radio wave echoes have been recorded from other planets, asteroids, tropospheric disturbances, and airplanes aloft. Microwave interferometry and scattering provides a rich platform enabling exploration of long-range microwave communications, remote sensing, and interesting astrophysical measurements. This class will cover the physics of microwave propagation and scattering, low-earth orbit (LEO) satellite trajectories and communications, moonbounce, short-baseline interferometry and the principles of ultrasensitive instrumentation - for both transmitting and receiving - enabling remote sensing with microwaves. One formal lecture per week will cover the fundamentals. The second weekly class meeting will be an extended hands-on workshop - starting mid-afternoon and going on into the evening - to assemble all aspects of a high-power microwave scattering system operating at 23cm. Students will set up tracking software for satellites and planetary objects, assemble an ultrasensitive software-defined radio (SDR) system, implement 1kW microwave power amplification at 23cm, and explore antenna and feed horn theory and practice. Also implemented will be powerful weak signal communications methods pioneered by Prof. Joe Taylor (*Physics, Princeton*) enabling ultraweak signal extraction through GPS synchronization of remote sources and receivers. We will employ Caltech's fantastic resources for this project - a 6-meter diameter microwave dish atop Moore Laboratory and a new 5-meter dish to be installed above Spaulding Building for this class. Prospective students are encouraged to obtain an FCC Technician license (or higher) *prior to spring term* to permit operation of the system. For info see: <http://www.its.caltech.edu/~w6ue/> Instructor: Prof. Roukes / K6QY



Official course sponsors:

