Brightness temperature of an FRB.
There is a dwarf galaxy about 1 Gpc away that is emitting Fast Radio Bursts: single, bright radio flashes. While observing at 1.4 GHz, a pulse with duration 0.1 ms and flux density 1 Jy is detected. Calculate the spectral brightness of the pulse and its corresponding brightness temperature. Hint: Stuck? Try some arguments about causality to help make an argument about the angular scale that the source of FRBs might subtend.

Mysterious sky emission
A researcher on Earth measures radio emission at a frequency of 250 kHz. This person estimates that the emission is present over the whole sky and that the brightness temperature is 250K. What power would be received by an antenna with a collecting area of $1m^2$ over a bandwidth of 1 kHz?

(If you get that done quickly…) Where this emission arise (in a general sense: is it likely terrestrial; solar system; galactic; extragalactic; CMB)? For reference, the electron density of the ISM is 0.03 cm^{-3}, solar wind ranges 10-10^3 cm^{-3}, and the ionosphere is an average of 10^5 cm^{-3}.

Be sure to turn your cell phone off when you get near GBT!
Most cell phones send and receive 4G data at a wavelength of around 1900 MHz. The `"low-power" transmitter on a cell phone can transmit up to around 2 W of power, transmitted over a bandwidth of 30 kHz. With a radio telescope on Earth observing at 1900 MHz over a narrow bandwidth of 10 kHz, approximately what flux density would you observe for an actively emitting cell phone sitting on the surface of the moon? (Note: consider the cell phone as an isotropic emitter. What does that mean about its power per unit angle?)