

Mini-groupwork 1, 2015

Space Physics, EF2240

In Figure 1 is shown a coronal loop, which may be associated with a solar flare. For scale, the size of Earth is indicated by the filled blue circle.

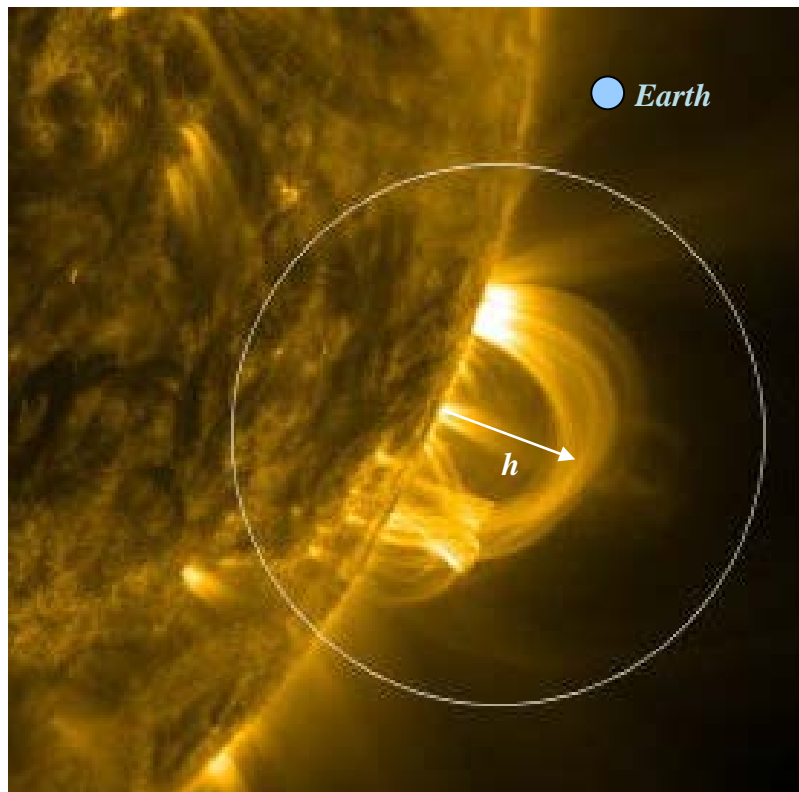


Figure 1

a) From the figure, estimate the height h of the coronal loop. If the plasma is heated to a temperature of $2 \cdot 10^6$ K at the top of the loop, estimate the average travel time, along the magnetic field, for an electron from the top of the loop to the solar surface. Assume that the magnetic field strength is constant along the coronal loop, and that the influence of gravity is negligible.

b) The gyrating electrons emit so called cyclotron radiation at the gyro (or 'cyclotron') frequency, which can be measured by remote instruments. If the gyro frequency of an electron in the plasma at the top of the coronal loop is 8 GHz, what is the magnetic field in the loop, and what is the electron gyro radius? (Note: what is measured is the real frequency, not the angular frequency.)

c) Estimate the total magnetic field energy of the coronal loop. Is the magnetic energy enough to produce a solar flare?