1 Solar Eruption Order-of-Magnitude

Show your rationale for the following questions.

(a) From the continuum image, estimate the fractional area (with respect to the solar hemispheric area) of active region 12192 and its unsigned magnetic flux (in Mx, i.e. G cm$^2$).

(b) Estimate the energy content of a large solar eruption (in erg).

(c) Some low-mass stars can produce large spots and “super flares”. For a star with solar radius and a spot group covering 10% of its hemisphere, estimate the energy content of its eruption (in erg).

(d) Estimate the Sun-Earth travel time of: flare emission, energetic particles, bulk plasma in coronal mass ejection, and ambient solar wind.

2 Grand Archive of Flare and CME Cartoons

Solar physicists are known for their artistic creativity. Dr. Hugh Hudson has gathered over 400 cartoons from literature regarding flare and CME processes.

Select one cartoon that interests you, browse the relevant paper, and write a short summary (~100 words). You do not have to agree with the paper’s conclusions.