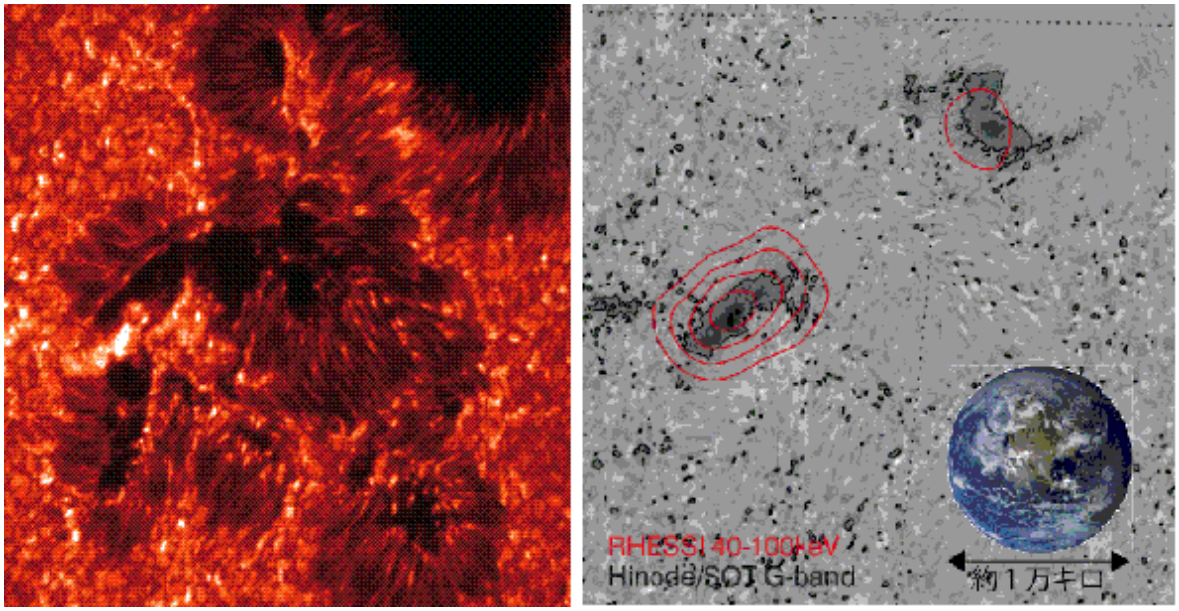

White light emissions were observed by the Hinode Solar Optical Telescope during an intense X-class flare on Dec. 14, 2006. The RHESSI satellite simultaneously recorded X-ray emissions (contours in right image) which are an indicator of electrons being boosted in energy during the flare event. The X-ray and optical emissions came from the same locations on the solar surface where electrons were being accelerated to over 40% the speed of light! This means that high-energy electrons are creating the white light flashes that are often seen in the most intense solar flares.

Problem 1 - From the size of Earth in the photo, the main flaring region has a length of 13,000 km and a width of 4,000 km. Assuming that it has a cylindrical shape, what is the volume of this region in cubic meters?

Problem 2 - The amount of magnetic energy stored in a volume of space of V cubic meters is given by the formula $E = 40{,}000\ B^2\ V$ where B is the magnetic field strength in units of Gauss, and where E is in units of ergs. What is the stored energy in this flaring region if B = 150 Gauss?

Problem 3 - If a 1-megaton hydrogen bomb produces an energy release of about 4×10^{22}, how much energy was released by this flaring region if all of the stored magnetic energy was involved in the flare?

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Answer: $V = \pi R^2 H$ so $V = 3.14 (4{,}000{,}000)^2 (13{,}000{,}000) =$ **1.6×10^{20} meters^3**

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$E = 40{,}000\ (150)^2\ (1.6 \times 10^{20}) =$ **1.4×10^{29} ergs**

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Answer: 1.4×10^{29} ergs **/** 4×10^{22} ergs = **3.5 million one-megaton bombs!**