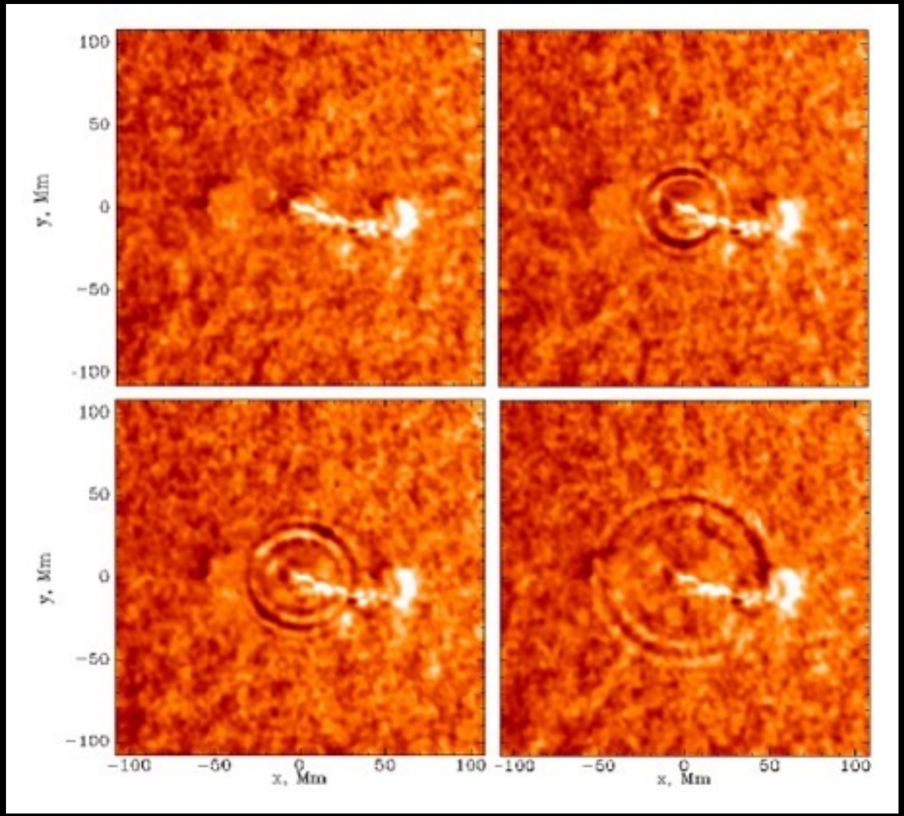
Explaining Sunquakes

While we usually think of solar flares as events that carry energy from the sun out into space, flares also affect the solar atomosphere below. A significant fraction of flare energy is transported from where they occur, high in the solar corona, toward deep layers of the solar atmosphere by highly-energized electrons, which are beamed downward along magnetic field lines.

Flares may even affect the photosphere, the deepest layer of the solar atmosphere, creating helioseismic waves called sunquakes, which propagate like ripples on a pond. Sunquakes have been difficult to explain, as current models attribute the heating to beams of electrons. Electrons cannot penetrate into the photosphere to the depths required to produce sunquakes.

Although difficult to detect, protons may be energized and beamed toward the lower solar atmosphere, along with electron beams. If so, they are a potential cause of sunquakes. This work shows the combination of proton beam heating simulations with an acoustic model of the Sun results in a photospheric effect of sufficient magnitude to explain the origin and transmission of helioseismic signals observed in sunquakes.

This is another step forward in understand the energy release and transport from solar flares. Solar flares are one of the main drivers of space weather and they can produce significant impacts on communications as well as human and autonomous space flight.



A sunquake created by a solar flare can release energy 40,000 times greater than a magnitude 8 earthquake. The compression waves accelerate to a speed of 250,000 miles per hour when they propagate through the sun. (Data from the MDI instrument aboard the ESA/NASA SOHO spacecraft.)

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