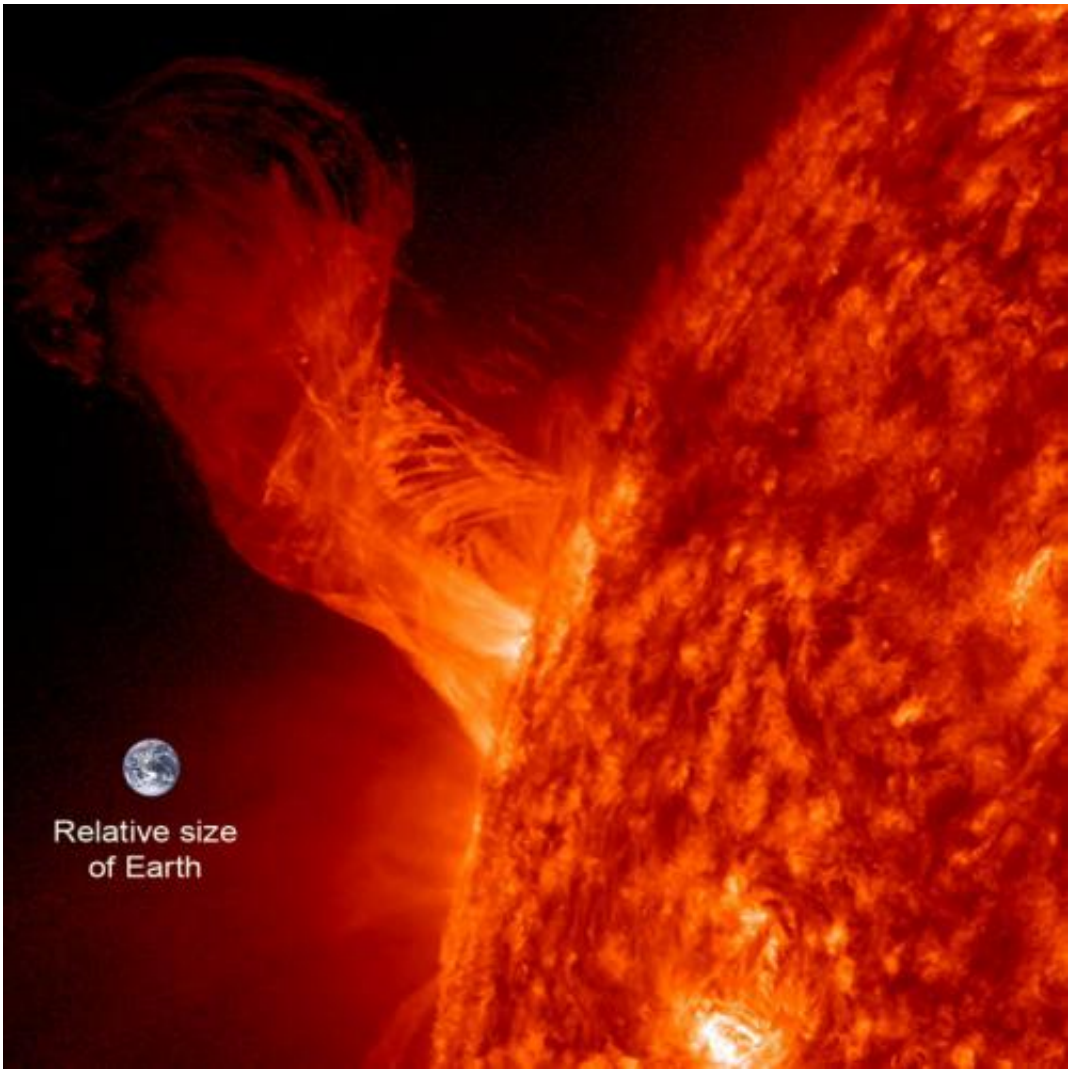
Fragments falling onto the Sun

July 1 2013



An image of a portion of the Sun's active corona as seen in the ultraviolet with the Solar Dynamics Observatory. A giant flare is present, with the Earth shown to size in the inset.

(Phys.org) —Stars form as gravity coalesces the gas and dust in an interstellar cloud until the material develops clumps dense enough to become stars. Even after a star begins to burn its nuclear fuel it continues to grow in mass as it accumulates matter from its natal cloud - and also from a surrounding ring of circumstellar material that develops. (This disk can subsequently produce planets.) Mass accretion from the circumstellar disk onto the stellar surface is expected to play an important role in star formation, especially in its later stages, but the process is very difficult to measure on other stars, leaving scientists uncertain about the many details.

Young low-mass stars are thought to interact with their circumstellar disks via magnetic funnels. Hot gas plasma accretes along these funnels, falling onto the stellar surface at velocities of hundreds of kilometers per second . Most of the evidence for this accretion comes from excess emission seen at infrared, optical, ultraviolet, and even X-ray wavelengths. Current models suggest that an impact region is rather complex because of the interplay between the radiation and the hot gas. According to models, the infalling material, after colliding back onto the surface, is heated to millions of degrees and partially sinks into the star's chromosphere. The impact can also drive strong motions and feed material back into surrounding coronal structures. The streams could be highly structured in both density and velocity, and result in inhomogeneous impact spots.

All these ideas are now being tested, thanks in part to the remarkable Solar Dynamics Observatory satellite that was launched in 2010 with an instrument team that included SAO scientists. In the latest issue of *Science Express*, SAO astronomer Paola Testa and five colleagues report discovering that fragments of ejected material from a solar flare fell back onto the Sun's surface and produced intense bursts of emission resembling those thought to occur in young stars. The scientists simulated the infall, and found good agreement between the models and

observations. It seems likely that studies of our own mature Sun will help unravel a mystery about how young stars develop.

Provided by Harvard-Smithsonian Center for Astrophysics

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