Nanodust particles in the interplanetary medium

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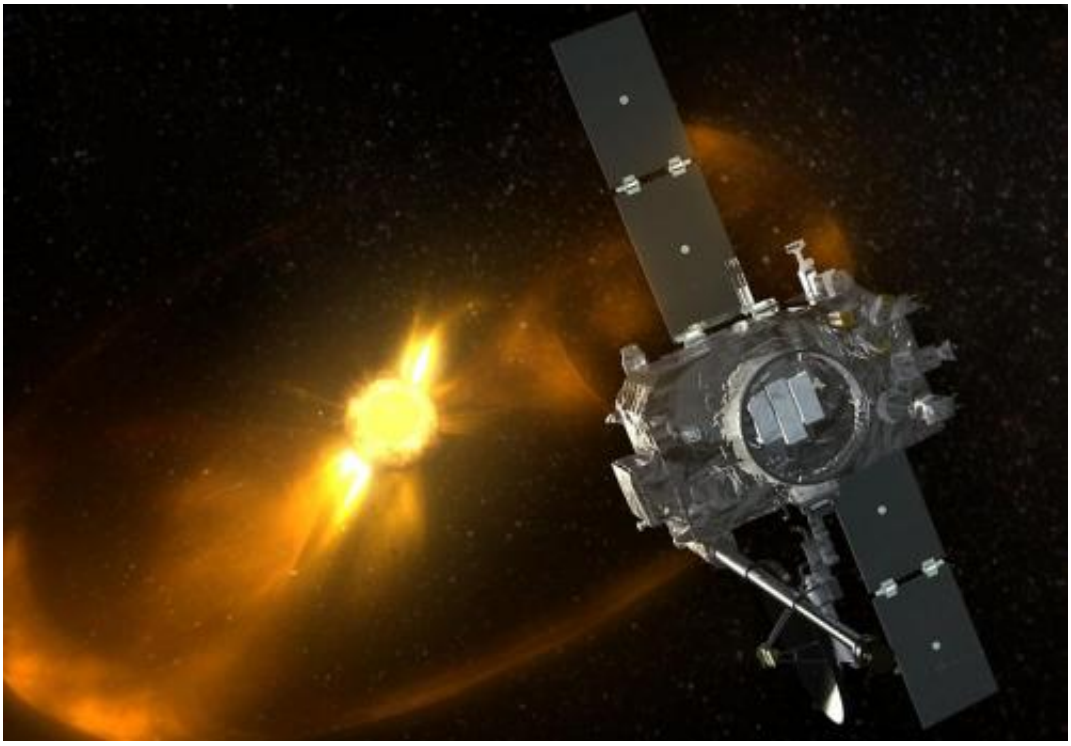

The STEREO (Solar TErrestrial RElations Observatory) spacecraft in an artist's conception, also showing a coronal mass ejection. Astronomers have discovered that these ejections accelerate and concentrate nanodust particles in the interplanetary medium, a conclusion derived from STEREO instruments that observed an increase in the rate of nanodust impacts on the spacecraft. Credit: NASA

Dust particles smaller than about a wavelength of light are abundant in

our solar system, created by collisions between asteroids and from the evaporation of comets. As they scatter sunlight, these particles produce the zodiacal light, the glow in the night sky that stretches along the zodiac. The zodiacal light is most easily seen after sunset or before sunrise, though it is faint enough that even moonlight can mask it. Nanodust particles are about ten times smaller than normal dust—too small to efficiently scatter sunlight. They can be sensed by spacecraft, however, because when they impact the spacecraft they generate puffs of ionized gas and electrical pulses that instruments can detect. The Solar TErrestrial RElations Observatory (STEREO) spacecraft has been detecting nanodust pulses since its launch in 2007, and previous studies of these events have confirmed the general picture that these tiny particles are an important constituent of the solar system.

The corona of the Sun, the hot (over a million kelvin), gaseous outer region of its atmosphere, is threaded by intense magnetic fields. The fields loop and twist, stirred by the motions of the hot gas in the underlying atmosphere. When these loops snap, they eject energetic charged particles into the solar wind in events called coronal mass ejections. Nanodust particles carry a slight electric charge, and because of that, the solar wind should be able to redistribute them as it blows toward Earth through interplanetary space.

CfA astronomer Gaetan Le Chat and his colleagues have analyzed seven years of data on nanodust obtained from the STEREO spacecraft and found that coronal mass ejections do indeed appear to accelerate and concentrate nanodust particles, leading to increased rates of impact on the spacecraft during periods of solar activity. The scientists also noted longer-term, regular variations in the rate of nanodust impacts, and propose from the periodic behavior that the gravitational influences of Mercury and Venus are responsible, perhaps by perturbing the tails of comets that have passed through the inner solar system, leading to a higher production of nanodust.

More information: "On the Effect of the Interplanetary Medium on Nanodust Observations by the Solar Terrestrial Relations Observatory," G. Le Chat, K. Issautier, A. Zaslavsky, F. Pantellini, N. Meyer-Vernet, S. Belheouane, and M. Maksimovic, *Solar Physics*, 2015. adsabs.harvard.edu.ezp-prod1.h … /2015SoPh..290..933L

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