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Cleansing the solar system: How the solar wind helps

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Part of the evolution of solar systems is the removal of the primordial dust, a process that continues today as dust is continually delivered to the inner solar system by comets. The classical cleansing process invokes the Poynting-Robertson effect that slows the dust particle that then spirals into the inner corona where it evaporates, ionizes and is carried away by the solar wind. But this is not the only way dust is removed. Dust interacts with the solar wind long before it is vaporized, then ionized. We have clear evidence for its interaction in the phenomena called an interplanetary field enhancement (IFE), that has cusp-shaped field strength enhancement and a thin central current sheet. Asteroid 2001 Oljato is associated with the periodic appearance of IFEs both well ahead of and well behind its arrival. IFEs are prevalent at all heliocentric distances but the events are stronger at lower heliocentric distances. These may not be the only phenomena associated with interplanetary dust. Comet McNaught appears to have created a dust-associated feature at Earth over 100,000,000 km away, well before it crossed the ecliptic plane. In fact much of the Alfvenic structure in solar wind could be created by charged dust. We presently do not have models that allow us to quantitatively interpret the potential signatures of dust in the interplanetary magnetic field. We need such models in order both to understand how the dust environment evolves and how the solar wind is affected by the dust it must traverse.