

Sources of Interplanetary Dust

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The interplanetary dust complex is manifested by the visible-wavelength zodiacal light from small particles near the Earth's orbit, particles captured by the Earth's atmosphere (collected by aircraft and observed as meteors), in-situ detections by spacecraft, and broad thermal emission observed from space. Understanding the origin of this dust received a major boost when the Infrared Astronomical Satellite was launched in 1983. For the first time, the strong signature of the zodiacal dust complex in the thermal infrared and parallel ring-like dust bands associated with collisionally produced families of asteroids were revealed. Long cometary dust trails were soon discovered and inferred to be associated with all short-period comets. Trails, in turn, indicated that comets were far 'rockier' than previously thought. Other broader trail-like structures (Type II) were detected that possibly originated from very recent asteroid collisions. Reexamination of early Pioneer data traveling beyond Jupiter and Saturn suggested that the dust detected originated from the Kuiper Belt, generated presumably by collisions. Subsequent spacebased infrared satellites have made observations providing deeper insights into the nature of these various phenomena. Recent analyses have identified dust bands arising from the stochastic disruption of small asteroids [1]. Most recently, a survey of comets by Spitzer has both confirmed IRAS-based inference of the commonality of trails, but has shown them to be quite diverse [2]. Spitzer scans of the zodiacal cloud has recovered Type II trails first detected by IRAS, suggesting they extend completely around their orbits [3]. However, the ability to go from sources of dust production to reproducing the zodiacal cloud as a whole has had limited success so far [4]. Now, our understanding of what comprises asteroid and cometary dust may have been turned on its head by the Wild 2 dust samples returned by Stardust [5].

Keywords: zodiacal dust, infrared, thermal emission, IRAS, COBE, ISO, Spitzer, Araki, comets, asteroids, KBOs.

References

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