

## Sources of zodiacal dust particles

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The orbital evolution of dust particles produced by asteroids, comets, and trans-Neptunian objects was integrated [1-3]. Analysis of results of these integrations testify in favor of a considerable fraction of particles produced by comets among overall zodiacal dust particles, but it does not contradict to  $>30\%$  of asteroidal dust needed for explanation of formation of dust bands. Fractions of asteroidal particles, particles originating beyond Jupiter's orbit (including trans-Neptunian particles), and cometary particles originating inside of Jupiter's orbit are estimated to be about  $1/3$  each, with a possible deviation from  $1/3$  up to  $0.1-0.2$ . Comparison of the plots of the number density vs. the distance  $R$  from the Sun obtained for particles produced by different small bodies with the plots based on observations shows that asteroidal and trans-Neptunian particles alone can not explain the observed almost constant number density at  $R \sim 3-18$  AU and a lot of particles must be produced by comets at  $R \sim 5-10$  AU [2-3]. Comparison of the WHAM (Wisconsin H-Alpha Mapper spectrometer) observations of spectra of zodiacal light with our models showed [4-5] that a significant fraction of particles produced by short-period comets is required to fit the observations of the width and velocity of the Mg I line. Comparison of the observations of the number density inside Jupiter's orbit with the number density of particles produced by different small bodies leads to the same conclusion about a considerable fraction of cometary particles. This comparison does not make limitations on cometary particles produced beyond Jupiter's orbit, but it shows that the fraction of particles produced by Encke-type comets (with eccentricities  $\sim 0.8-0.9$ ) does not exceed  $0.15$  of the overall population. The estimated fraction of particles produced by long-period

and Halley-type comets among zodiacal dust also does not exceed 0.1-0.15. Though trans-Neptunian particles fit different observations of dust inside Jupiter's orbit, they can not be dominant in the zodiacal cloud because they can not be dominant between orbits of Jupiter and Saturn. The conclusion on a considerable fraction of cometary dust is also in an agreement with our studies [6] of the dynamics of Jupiter-family comets, which showed that some former cometary objects could get high eccentric orbits located entirely inside of Jupiter's orbit and stay in these orbits for a long time. Some of these objects could disintegrate producing a substantial amount of dust.

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