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The discussions of the force which the interstellar dust grains flowing into the solar system are dominated

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The interstellar neutral gas flows into the solar systems taking with the interstellar dusts. But the distribution of the interstellar dusts is disturbed by the solar gravity, radiation pressure, and Lorentz force. We discuss about these representative three forces which dominate the motion of interstellar dusts in the solar system.

First, we assumed that the grain is the silicate as a refractory material. We calculated the charge of the interstellar dusts with each sizes flowing into the solar system as a function of the heliocentric distance because it differs in the each positions. Then we made the equations of motion to make clear the trajectory of the grains. We found that domination by each three forces, which can be distinguished from 3 parts and 2 sub-parts.

The Ulysses spacecraft founded the flux of the interstellar dusts at an orbit of around the Jupiter (Grun et al. 1993). They identified them as interstellar origin dusts because of the fixed incoming direction onto the dust detector and orbital velocity exceeded over 26 km/sec. The Sun is revolving around a center of the galaxy in the direction of Hercules. The flux of the interstellar dusts is caused by the motion of the Sun with respect to the local interstellar medium, and its flux direction in the solar system is comparable to the flux of the interstellar neutral gas (mainly helium) that enters the solar system (Frisch et al. 1999). Subsequently, The data of the Hiten and Galileo spacecrafts were looked again and reported that these interstellar origin dusts could be distinguished from interplanetary dusts (Svedhem et al. 1996, Grun et al. 1995).

Taylor et al. (1996) reported the interstellar dusts entering the atmosphere of the earth detected by the meteor radar observation, they identified them as interstellar dusts whose observed velocities over 100 km/sec. The mass distribution that was derived from Ulysses data for the measured interstellar dusts component has a maximum at around 3*10(-13)g (or radius is about 0.3 micron with density 2.5 g/cm(3)) ranging from 10(-16) to 10(-10)g (or radius is about 0.02 to 2 micron with density 2.5 g/cm(3)) (Grun et al. 1994) (the number in a parentheses shows an index). Subsequent study Grun et al. (1995) reported that the average mass of the total detected grains sample is 2*10(-12)g for Galileo and 1*10(-12)g for Ulysses data (or radius is about 0.5 to 0.6 micron with density 2.5 g/cm(3)). These correspond to the upper part of the size distribution of interstellar dusts that is derived from interstellar extinction curves and mainly describes the grains that are smaller than 3*10(-13)g (Mathis et al. 1977 (MRN), Mathis 1990). Although the size distribution of average interstellar dusts cloud may not be identical to the size distribution in the local interstellar medium close to the solar system, there is no evidence for big differences between these components.

Basically, the mass distribution of interstellar dusts can be modified in the solar system under the influence of the solar gravity and radiation pressure force, as well as the Lorentz force. The initial strict study of the interstellar dust flow into the solar system is Gustafson and Misconi (1979), which showed the interaction between interstellar grains and solar wind including the effects of solar cycle variation so that they predicted the existence of significantly affected regions of concentration and depletion of interstellar grains within the solar system. Grun et al. (1994) and Gustafson and Lederer (1996) simulated under the circumstances of periodic solar conditions when the Ulysses had observed. Grogan et al. (1996) also considered including the effects of the zodiacal thermal emissions contributed by interstellar dusts. But there is no study discussing about the dominant force to the interstellar dusts in the solar system considering the differentiations of heliocentric distance of charge of dusts. We make it clear that how far distance the interstellar dusts could approach to the Sun under changeable charge of the grains.

First, we assumed that the grain is the silicate as a refractory material. We calculated the charge of the interstellar dusts with each sizes flowing into the solar system as a function of the heliocentric distance because it differs in the each positions. Then we made the equations of motion to make clear the trajectory of the grains. We found that domination by each three forces, which can be distinguished from 3 parts by the radius range; (1) >0.5 micron: gravity dominated, (2) 0.5-0.1 micron: radiation pressure dominated, (3) <0.1 micron: Lorentz force dominated. Moreover 2 sub-parts can be seen; (4) around 0.4 micron: the most not-affective, (5) 0.08-0.1 micron: relatively weak Lorentz force.