Magnetic Motions of Diamagnetic Dust Particles

Induced by Weak Field Intensity.

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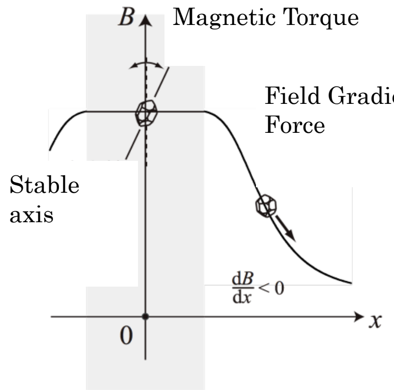
Effect of magnetic field on solid has been recognized only for minerals that include ferro-, ferri- or para-magnetic phases. Rotational oscillation of crystalline axis with respect to magnetic field B was observed for various diamagnetic crystals released in a diffused, space at microgravity condition[1]; the oscillation was caused by diamagnetic anisotropy $\Delta\chi_{DIA}$ of the material. Furthermore, the crystals were ejected toward the area of B = 0 by field gradient force [2]. In a given gradient, acceleration a of particle was independent to its mass; a was uniquely determined by diamagnetic susceptibility χ_{DIA} of the material. The field that induced the 2 motions was produced by a NdFeB magnet (B_{max} <1T).

The conditions of diffused pressure and micro-gravity achieved in the above experiments are satisfied in most of the inter- & circum-stellar regions, where magnetic field and diamagnetic dusts are both omnipresent. Hence the two effects should be taken into account in studying the dynamic motions of dusts in this region. For example, mechanism of dust alignment may be explained by a balance between thermal energy and field- induced anisotropy energy; here it is essential to obtain $\Delta\chi$ of a single-grain using the above observation, in order to evaluate the proposed mechanism quantitatively.



The above rotation and translation was extended to μm-sized samples of forsterite, diamond, graphite & SiC in the present work, in order to examine the mass independent properties in the micron region between φ5000~50μm. This is done by comparing the measured χ and $\Delta\chi$ with the published values[3]. Furthermore, we propose that the 2 motions are effective to identify the material of a single dust particle.

Reference: [1]Jpn.J.Appl.Phys. (2006) 45 L124. [2] J. Phys. Soc. Jpn. (2010) 79
[3] R. Guputa: "Landort Bornstein" New Series II (1983) 445.