Magnetic Motions of Diamagnetic Dust Particles
Induced by Weak Field Intensity.

C. UYEDA, and K. HISAYOSHI
Institute of Earth and Space Science, Graduate School of Science, Osaka University

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 $\Delta \chi_{\text{DIA}}$ 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 $\chi_{\text{DIA}}$ of the material. The field that induced the 2 motions was produced by a NdFeB magnet ($B_{\text{max}} < 1T$).

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 $\mu$m-sized samples of forsterite, diamond, graphite & SiC in the present work, in order to examine the mass independent properties in the micron region between $\varphi 5000\sim 50\mu m$. This is done by comparing the measured $\chi$ 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.