Measurement of Diamagnetic Anisotropy $\Delta\chi_{DIA}$ using Micro-Gravity Orientated to Investigate the Origin of Interstellar Dust Alignment

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Direction of inter-stellar magnetic field is commonly estimated from the polarization of star light; the polarization is considered to occur by magnetic alignment of the dust. However, the mechanism of alignment is still debatable for the dense region [1]. We proposed a model for alignment which is based on the anisotropy of the diamagnetic susceptibility $\Delta\chi_{DIA}$ [2]. In order to evaluate the model quantitatively, it is essential to obtain $\Delta\chi_{DIA}$ of the dust-size crystals. The measurement is difficult by the conventional methods because $\Delta\chi_{DIA}$ is generally very small. In this study, $\Delta\chi_{DIA}$ of sub-mm sized crystals were obtained for the first time, by measuring the period of rotational oscillation caused by field-induced anisotropy energy; here the crystals were released in micro-gravity produced by a drop capsule. The measurement is possible because the method does not require a sample holder, and mass measurement. The $\Delta\chi_{DIA}$ values were obtained for calcite and α-quartz that was as small as ~0.3mm in diameter. The $\Delta\chi_{DIA}$ value of calcite did not depend on mass. In case of α-quartz, $\Delta\chi_{DIA}$ increased with the reduction of mass. The reason of the mass dependence is unknown as yet, however the result is effective to reduce the field intensity that is necessary to cause dust alignment in interstellar condition.

Keywords; micro gravity, magnetic dust alignment

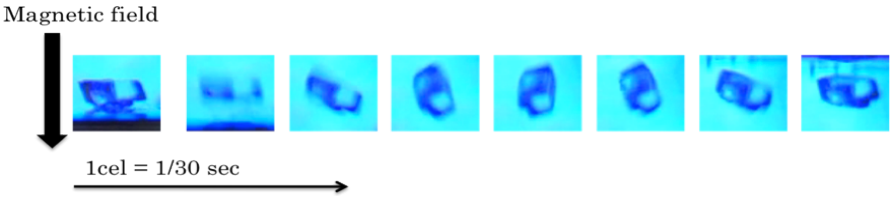

Figure 1. Measurement of the diamagnetic susceptibility $\Delta\chi_{DIA}$; $\Delta\chi_{DIA}$ are obtained from the period of rotational oscillation in micro gravity.

References

[1] L. Spitzer (1978) Wiley, New York, "Physical Processes in the Interstellar Medium", chap.8

[2] C. Uyeda, T. Komatsu, M. Sakakibara, and K. Tanaka: A & A 400,805-810(2003)