かぐや磁場観測とダイナモモデルによる月ダイナモ仮説の検討

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Examination of a lunar dynamo hypothesis by Kaguya/LMAG observation and numerical dynamo modeling

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One of the objectives of magnetic field observation around the Moon by the Lunar Magnetometer (LMAG) onboard the Kaguya spacecraft is to examine if the Moon once had a global magnetic field of core origin. For this purpose, we have conducted a systematic study of modeling the lunar crustal magnetic field, called the lunar magnetic anomaly, based on a dipole source assumption. Among more than 30 anomalies, we particularly focus on small-scale, isolated anomalies, taking the dipole source assumption into account. Using a dataset obtained during a period of Kaguya low altitude observation, it is found that not only the well known, strong magnetic anomalies, Reiner Gamma and Descartes anomalies (>> 10 nT in strength below 20 km altitude), but also relatively weak anomalies (Abel, Airy, Crisium, Hartwig, Heaviside, Jackson, Kolorev, Krasovsky Mendel-Rydberg, Moscoviense, Rima Sirsalis, Stofler and so on) including some currently unnamed anomalies of ˜10 nT below 20 km altitude can be modeled using single- or multi-dipole sources. After modeling all the anomalies, which can be represented by dipole source, the obtained magnetization directions are mapped into distribution of paleo-poles to discuss the ancient lunar dynamo hypothesis. It is found that anomalies associated with the Nectarian-aged impact basins tend to concentrate around the selenographic poles, while those associated with the pre-Nectarian-aged basins do not. These results might imply that the paleo-poles derived from the pre-Nectarian and Nectarian magnetic anomalies are records of temporal evolution of a core dynamo from a frequently reversing multi-polar state without a solid inner core to a stable dipolar state with a well grown-up inner core.