

## Numerical investigation of radiation shielding using planetary magnetic fields

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### ● Abstract

For manned space exploration, space radiation causes harsh radiation exposure. To protect crews from radiation exposure, we propose radiation shielding using planetary magnetic fields. We evaluate the magnetic shielding by numerical simulation because the planetary magnetic field expands the large area. We simulate space radiation in the planetary magnetic field and clarify the performance of the magnetic shielding.

### ● Reasons for using of JSS2

We need large-scale parallel computing to simulate trajectories of many energetic particles.

### ● Achievements of the Year

We focus on Martian magnetic anomalies and conducted the simulation of the radiation shielding. We simulated trajectories of energetic particles using a relativistic Buneman-Brois method and evaluated the radiation shielding using the magnetic anomaly. Figure 1 shows a distribution of normalized particle hits reaching the Martian surface. The magnetic anomaly could completely shield energetic particles with a specific incident angle. The complete shielding means that the radiation exposure is zero on the Martian surface. Martian magnetic anomalies could realize the radiation shielding from energetic particles.

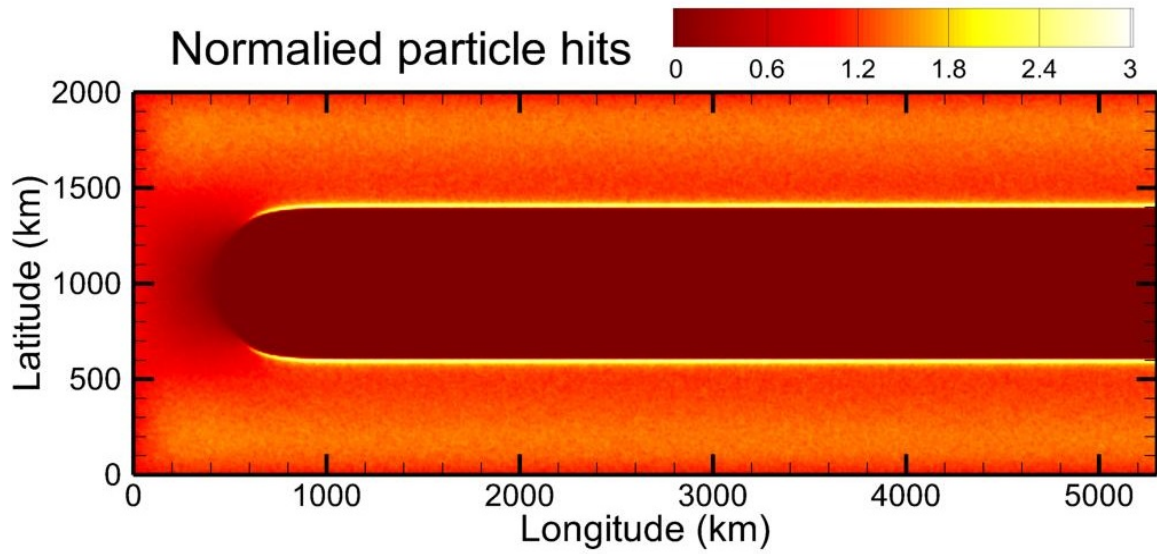


Fig.1 A distribution of normalized particle hits

#### ● Publications

- Peer-reviewed papers

- 1) Kazuma Emoto, Yoshinori Takao, and Hitoshi Kuninaka: A Preliminary Study on Radiation Shielding Using Martian Magnetic Anomalies, *Biological Sciences in Space*, in press.

- Presentations

- 1) Kazuma Emoto, Yoshinori Takao, and Hitoshi Kuninaka: A Preliminary Investigation on Radiation Shielding Using Martian Magnetic Anomalies, *Space Transportation Symposium FY2017*, STEP-2017-021, Sagamihara, January 2018.

## ● Usage of JSS2

### ● Computational Information

Parallelization Methods	MPI
Thread Parallelization Methods	N/A
Number of Processes	3020
Elapsed Time per Case	4.00 hours

### ● Resources Used

Fraction of Usage in Total Resources\*1 (%): 0.04

Details

Computing Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage*2 (%)
SORA-MA	329,457.50	0.04
SORA-PP	0.00	0.00
SORA-LM	0.00	0.00
SORA-TPP	0.00	0.00

File System Resources		
File System Name	Storage assigned(GiB)	Fraction of Usage*2 (%)
/home	014.31	0.01
/data	143.05	0.00
/ltmp	2,929.69	0.22

Archiver Resources		
Archiver System Name	Storage used(TiB)	Fraction of Usage*2 (%)
J-SPACE	0.00	0.00

\*1 Fraction of Usage in Total Resources: Weighted average of three resource types (computing, file system, and archiver)

\*2 Fraction of Usage: Percentage of usage relative to each resource used in one year