Numerical Study of Breakdown and Shock Wave Structures for Improvement of Flight Performance in a Beamed-energy Vehicle

Report Number: R21EACA17
Subject Category: JSS Inter-University Research
URL: https://www.jss.jaxa.jp/en/ar/e2021/18135/

Responsible Representative

Masayuki Takahashi, Associate Professor, Tohoku University

Contact Information

Masayuki Takahashi, Tohoku University(mtakahashi@rhd.mech.tohoku.ac.jp)

Members

Soichiro Suzuki, Hoshiki Sato, Naoki Tsunezawa, Masayuki Takahashi

Abstract

Objective of this study is revealing a discharge process on beaming propulsion system and finding a condition in which a thrust performance is maximized through numerical simulaiton.

Reasons and benefits of using JAXA Supercomputer System

It is necessary to use JAXA super computer because a beam-induced discharge is induced by an interaction of multi-scale processes and a computational cost becomes huge.

Achievements of the Year

By constructing a plasma model with the electromagnetic wave propagation, plasma drift diffusion, neutral particle transport, detailed chemical reaction, radiation transfer modules, it is found that thermal and associative ionizations are important on a propagation of beam-induced plasma. This is the first achievement result in the world. A multi-dimensional simulation indicates that a speeding-up of the plasma-front propagation is obtained because the electric field at the plasma front is enhanced by multi-dimensional interference of the incident beam and an electron-impact ioniztion frequency is increased.

Publications

N/A

Usage of JSS

Computational Information

Process Parallelization Methods	MPI
Thread Parallelization Methods	N/A
Number of Processes	1 - 128
Elapsed Time per Case	20 Hour(s)

JSS3 Resources Used

Fraction of Usage in Total Resources[*1](%): 0.01

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage[*2](%)
TOKI-SORA	245,803.92	0.01
TOKI-ST	12.55	0.00
TOKI-GP	0.00	0.00
TOKI-XM	0.00	0.00
TOKI-LM	0.00	0.00
TOKI-TST	0.00	0.00
TOKI-TGP	0.00	0.00
TOKI-TLM	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage[*2](%)
/home	530.00	0.53
/data and /data2	10,540.00	0.11
/ssd	400.00	0.10

Archiver Resources		
Archiver 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.

- **ISV Software Licenses Used**

ISV Software Licenses Resources		
	ISV Software Licenses Used (Hours)	Fraction of Usage*2(%)
ISV Software Licenses (Total)	0.00	0.00

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