

Harihara Sudhan Kumar

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PROFILE

I am a postdoctoral researcher interested in stability of kinetic plasma using theory and simulations. My research interests include (but not limited to) electric propulsion, plasma instabilities, and kinetic processes. With a solid foundation in theoretical, simulation, and experimental plasma physics, I am eager to use my research, writing, and presentation skills in a demanding R&D setting. I am also enthusiastic about opportunities which leads to engaging with interdisciplinary projects.

EDUCATION

- 📅 2020/10–2023/09 PhD in Aerospace Engineering - JSPS Fellow
Tohoku University 📍 Sendai, Japan
- » Developed a coupling multiphysics simulation methodology study the effect of laser prepulse on ion acceleration from an ultra-thin (< 10 nm) graphene target.
 - » Developed an algorithm using FORTRAN90 and Python to bridge molecular dynamics (MD) simulation of the laser pre-pulse with the particle-in-cell (PIC simulation) of the main pulse.
 - » Based on simulations, proposed a theoretical framework for categorizing the acceleration types in laser accelerated plasma.
- 📅 2018/10–2020/09 M.S. in Aerospace Engineering - MEXT Scholar
Tohoku University 📍 Sendai, Japan
- » Developed a theoretical gyro-kinetic model to explain the presence of a plasma double layer in a novel thruster concept called the Traveling Magnetic Field Thruster.
 - » Build a computational 1D PIC electrostatic thruster model using C++ and validated the theoretical findings.
 - » Carried out further validation using a dimensionality reduction algorithm called Dynamic Mode Decomposition and conclusively proved the results from theory and simulation.
 - » GPA: 3.2/4.0
- 📅 2013/06–2017/04 B.Tech. in Aerospace Engineering
Amrita School of Engineering 📍 Coimbatore, India
- » Carried out ANSYS fluid simulations on film cooling of rocket nozzles to study the coolant-exhaust interaction.
 - » Used RANS with $k - \omega$ turbulence model to study the mixing of the coolant with the exhaust gas while monitoring the evolution of the boundary layer.
 - » GPA: 3.12/4.0

WORK EXPERIENCE

- 📅 2022/04–current JSPS Researcher
Tohoku University/JSPS 📍 Sendai, Japan
- » Primary responsibility: To simulate and analyze high intensity laser interaction with plasma using algorithms developed in FORTRAN, C++, and Python.
 - » Secondary duties involve guiding student projects (4 projects) and code development.
- 📅 2015/08–2017/04 Student Research Assistant
Nanomaterials Research Lab., Amrita Uni. 📍 Coimbatore, India
- » Developed a simulation model for the cold spray deposition of microparticles on a metallic target using a CD nozzle in ANSYS.

📅 2015/06–2015/07

Student Intern

Hindustan Aeronautics Limited

📍 Bengaluru, India

- » Performed experiments to visualize the effect of vibrations on the hydraulic fluid transport in helicopters.

SKILLS

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|---|-----------|
| Python, LaTeX, HTML/CSS/Javascript | ● ● ● ● ● |
| Particle-in-Cell, Plasma Physics, MS Office | ● ● ● ● ● |
| Molecular Dynamics, C++, MATLAB | ● ● ● ● ● |
| Processing, FORTRAN, OpenMP, MPI | ● ● ● ● ● |
| AutoCAD, ANSYS, COMSOL, Bash | ● ● ● ● ● |

PUBLICATIONS

- » **Kumar H S**, Prasad K, Kothurkar N K, and Srikrishnan, Studies on Supersonic Cold Spray Deposition of Microparticles using a Bell-Type Nozzle, *Surface Coatings Technology* **383**, pp. 125244, 2020.
- » **Kumar H S**, Takahashi M, and Ohnishi N, Numerical Simulation of Particle Acceleration in Traveling Magnetic Field Thruster, *Transactions of the Japan Society for Aeronautical and Space Sciences, Aerospace Technology Japan* **18**, pp. 317–322, 2020.
- » **Kumar H S**, Takahashi M, Kato C, Oshio Y, and Ohnishi N, Kinetic Theory of Double Layers Driven by Temperature Anisotropy in a Non-Homogeneous Magnetic Field, *Journal of Applied Physics* **130**, 163303, 2021.
- » Kuramitsu Y, Minami T, ..., **Kumar H S**, Ohnishi N, ..., Fukuda Y, Robustness of Large-Area Suspended Graphene under Interaction with Intense Laser, *Sci Rep* **12**, 2346, 2022.
- » Somasekharan N, Srikrishnan A.R, **Kumar H S**, Ganesh K P, Mohammad A, Velamati R.K, Enhancement of Film Cooling Effectiveness in a Supersonic Nozzle, *Entropy* **25**, 481, 2023.
- » **Kumar H S**, Characterization of Stability of Dynamic Particle Ensemble Systems using Topological Data Analysis, *Chaos* (under review).
- » **Kumar H S**, Takahashi M, Kuramitsu Y, Ohnishi N, Tailoring Radiation-Dominant Hybrid Acceleration: A Framework for Quantifying Sheath and Radiation-Based Acceleration Contributions, *Physical Review Research* (under review).

CONFERENCES

- » **Kumar H S**, Takahashi M, and Ohnishi N, Numerical Simulation of Particle Acceleration in Traveling Magnetic Field Thruster, *32nd International Symposium on Space Technology and Science*, **2019-b-076 (190133)**, 2019, Fukui, Japan.
- » **Kumar H S**, Takahashi M, and Ohnishi N, Numerical Simulation and Theoretical Analysis of Particle Acceleration in Traveling Magnetic Field Thruster, *36th International Electric Propulsion Conference, IEPC-2019-795*, 2019, Vienna, Austria.
- » **Kumar H S**, Takahashi M, Kato C, and Ohnishi N, Interaction Between a Soliton and a Double Layer in a Traveling Magnetic Field System, *62nd Annual Meeting of the APS Division of Plasma Physics*, **JO-05-00002**, 2020, Online.
- » **Kumar H S**, Takahashi M, Kato C, and Ohnishi N, Investigating the Existence of a Double Layer and Multiple Soliton Solutions in a Traveling Magnetic Field System, *Reiwa 2nd Space Transportation Symposium*, 2020, Online.
- » **Kumar H S**, Takahashi M, Kuramitsu Y, Minami T, and Ohnishi N, A Coupling Simulation Integrating Molecular Dynamics and Particle-in-Cell Methods for Accurate Intense Laser-Target Simulations, *13th International Conference on High Energy Density Laboratory Astrophysics*, 2022, Lisboa, Portugal.

- » **Kumar H S**, Takahashi M, Kuramitsu Y, Minami T, Kiriya H, Fukuda Y, and Ohnishi N, Energetic Ion Generation through Hybrid Acceleration from Ultra-Thin Graphene Targets for Good Contrast Linearly Polarized Laser Pulses, *12th International Conference on Inertial Fusion Sciences and Applications*, 2023, Colorado, U.S.A.

LANGUAGES

- » Tamil (Native)
- » English (Fluent) TOEFL - 111/120
- » Japanese (Intermediate)

OTHER

- » (2017/08) Winner of One-Size-Fits-All: X-ray Plate Adapter Challenge by General Electric Oil & Gas.
- » (2017/10 – 2022/03) Recipient of MEXT scholarship.
- » (2018/10 – 2022/03) Treasurer of TEDxTohokuUniversity.
- » (2022/04 – 2023/09) Recipient of JSPS Doctoral fellowship.
- » (2023/09 – 2024/03) Recipient of JSPS Postdoctoral fellowship.
- » (2023/01 – present) Coding mentor for high school students at Waffle NPO Japan.

REFERENCES

Available upon request.