Website Information
Department of Physics
Dayananda Sagar University

Faculty details:

Item	**Details**
Faculty Name:	Dr. Prachi Sharma
Room No:	A-318
Designation:	Assistant Professor
E-Mail	prachisharma-phy@dsu.edu.in
Research area:	Plasma Physics (Nonlinear wave-wave interaction, Topological invariants in MHD)
Publications (Past 5 years)	1. **Sharma, P.** & Yahalom, A. (2025). Conservation of momentum in relativistic motors. Bulgarian Journal of Physics, 52(s1), 165–172. 2. **Sharma, P.** & Yahalom, A. (2025). Energy conservation in a charged retarded field engine. Energies, 18(17), 4661. 3. **Sharma, P.** & Yahalom, A. (2024). A charged relativistic engine based on a permanent magnet. Applied Sciences, 14(24), 11764. 4. **Sharma, P.** & Yahalom, A. (2023). Generalized chi and eta cross-helicities in non-ideal magnetohydrodynamics. Symmetry, 15(12), 2203. 5. **Sharma, P.** & Yahalom, A. (2023). Generalized cross-helicity in non-ideal magnetohydrodynamics. Journal of Plasma Physics, 89(6), 905890604. 6. **Sharma, P.** & Gedalin, M. (2023). Non-specular ion reflection at quasiperpendicular collisionless shock front. Journal of Plasma Physics, 89(5), 905890505. 7. Gedalin, M. & **Sharma, P.** (2023). Effect of the reflected ions on the magnetic overshoot of a collisionless shock. Physics of Plasmas, 30, 072905. 8. Rai, R.K., Pathak, N., **Sharma, P.**, Sharma, S., Yadav, N. & Sharma, R.P. (2021). Turbulence generation of ion scale in the presence of magnetic islands and guide field at the magnetopause region. Journal of Astrophysics and Astronomy, 42, 1.
Profile Links: Scopus and Orcid	https://scholar.google.co.in/citations?user=dwX72DMAAAAJ&hl=en **Scopus ID:** 57391259300 **Orcid :** 0000-0003-4116-0468

Research Activities (Write about your best research results max of 2-3 pages including diagrams)

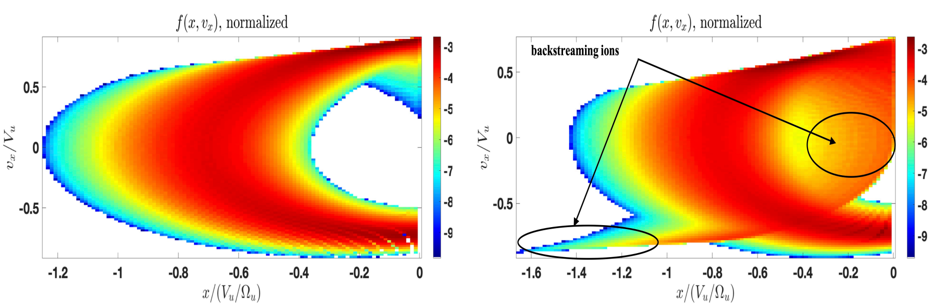
- **Generalized cross-helicity in non-ideal magnetohydrodynamics**
  https://doi.org/10.1017/S002237782300123X

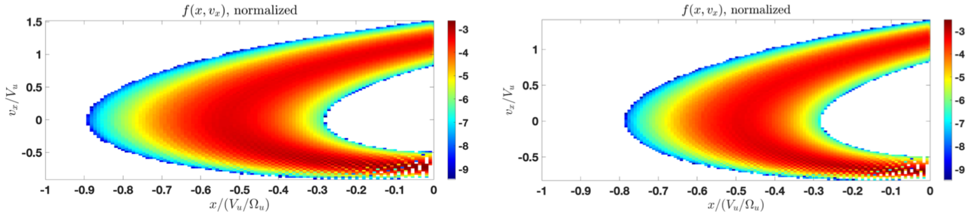
This work investigates the constancy of the topological invariant, denoted the non-barotropic generalized cross-helicity in the case of non-ideal magnetohydrodynamics (MHD). Existing work considers only ideal barotropic MHD and ideal non-barotropic MHD. Here, we consider dissipative processes in the form of thermal conduction, finite electrical conductivity and viscosity and the effect of these processes on the cross-helicity conservation. An analytical approach has been adopted to obtain the mathematical expressions for the time derivative of the cross-helicity. Obtained results show that the generalized cross-helicity is not conserved in the non-ideal MHD limit and indicate which processes affect the helicity and which do not. Furthermore, we indicate the configurations in which this topological constant is conserved despite the dissipative processes.

$$\frac{dH_{CNB}}{dt} = \int \left\{ \frac{\eta}{4\pi}\vec{v}_t \cdot \nabla^2 \vec{B} + \frac{B_i}{\rho}\frac{\partial \sigma'_{ik}}{\partial x_k} + \frac{\left(\vec{B}\cdot\vec{\nabla}\sigma\right)}{\rho T}\left(\sigma'_{ik}\frac{\partial v_i}{\partial x_k} + \eta J^2 + k\nabla^2 T\right)\right\} d^3x$$

- **Non-specular ion reflection at quasiperpendicular collisionless shock front**
  https://doi.org/10.1017/S002237782300096X

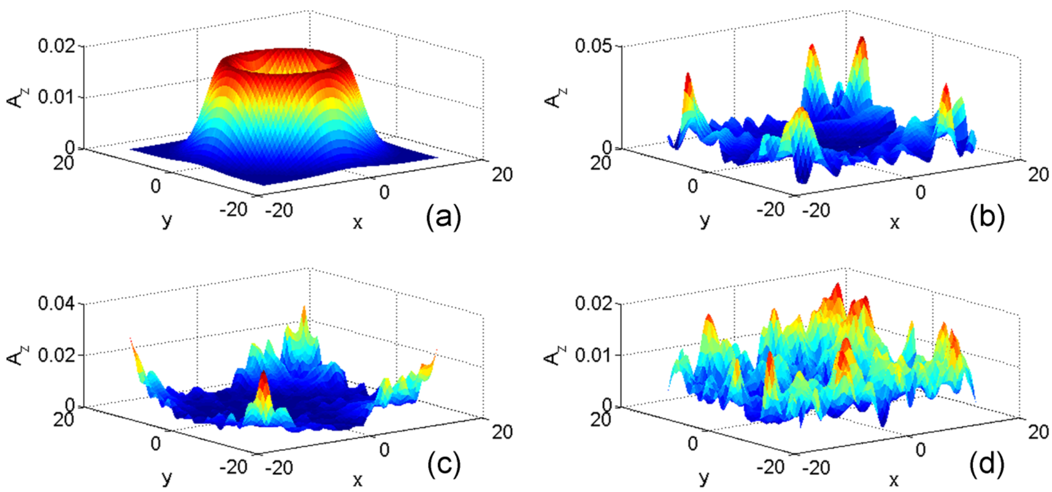
The structure of a collisionless shock affects ion motion in the shock front and is affected by the formed ion distribution. In high-Mach-number shocks, a significant fraction of incident ions is reflected by the macroscopic electric and magnetic fields in the shock front. Ions are non-specularly reflected by the combined electric deceleration and magnetic deflection. Here, a first analytical description of the non-specular reflection is presented. The contribution of the increasing magnetic field is evaluated and shown to enhance reflection. The distribution of non-specularly reflected ions ahead of the ramp is calculated and their velocities at the re-entry to the shock are found numerically. Dependence on the angle between the shock normal and the upstream magnetic field vector is illustrated.





- ➢ **Nonlinear Evolution of a 3D Inertial Alfvén Wave and Its Implication in Particle Acceleration**
  <u>https://doi.org/10.1007/s11207-016-0870-9</u>

A model for the acceleration of charged particles by field localization is developed for the low-β plasma. For this purpose, a fractional diffusion approach has been employed. The nonlinear interaction between a 3D inertial Alfvén wave and a slow magnetosonic wave has been examined, and the dynamical equations of these two waves in the presence of ponderomotive nonlinearity have been solved numerically. The nonlinear evolution of the inertial Alfvén wave in the presence of slow magnetosonic wave undergoes a filamentation instability and results in field intensity localization. The results obtained show the localization and power spectrum of inertial Alfvén wave due to nonlinear coupling. The scaling obtained after the first break point of the magnetic power spectrum has been used to calculate the formation of the thermal tail of energetic particles in the solar corona.



Collaborations	Prof. R. P. Sharma, IIT Delhi Prof. Asher Yahalom, Ariel University, Israel Prof. Ioannis Kourakis, Khalifa University UAE Dr. Nitin Yadav, IIT Delhi Dr. Michael Gedalin, Ben Gurion University, Israel
Awards and Recognitions	• **Best Poster Award**: 29th National Symposium on Plasma Science & Technology, **Mahatma Gandhi University, Kerala** (Dec 2014) • **Shri Hoti Lal Upadhyaya Memorial Scholarship:** M.Sc. (F) (2010) • Received **official institutional appreciation for consistently positive student feedback** and **teaching effectiveness (MITS, Gwalior).**