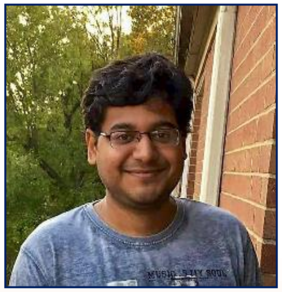
PARVEZ GUZDAR YOUNG SCIENTIST AWARD LECTURES

On

21st. January 2021, 10.30 am (IST); Online Link: Award Lecture



Dr. Riddhi Bandyopadhyay

Dr. Bandyopadhyay is presently a Postdoctoral Research Associate at Department of Astrophysical Sciences, Princeton University. He has been chosen for the **PARVEZ GUZDAR YOUNG SCIENTIST AWARD 2020** for his significant scientific contributions in **the study of waves and instabilities in the area of magneto-hydrodynamic turbulence and its manifestations in astrophysical plasmas.**

Dr. Bandyopadhyay obtained his Bachelor's and Master's degrees in Physics from St. Xavier's College, Kolkata, University of Calcutta, and IIT Kanpur respectively. He received his PhD at the University of Delaware in February 2020 under the supervision of Dr. William Matthaeus.

His research interest involves turbulence in space and astrophysical plasmas. He is a team member in several NASA missions like Magnetospheric Multiscale (MMS) mission, Parker Sola Probe (PSP), and Interstellar Mapping and Acceleration Probe (IMAP).

Dr. Soumen Ghosh

Dr. Ghosh is presently a Postdoctoral Scholar at Department of Physics, University of California, San Diego. He has been chosen for the **PARVEZ GUZDAR YOUNG SCIENTIST AWARD 2020** for his significant scientific contributions in **the experimental studies of basic plasma phenomena including helicon wave generation and positron beam physics.**

Dr. Ghosh obtained his Bachelor's and Master's degrees in Physics from University of Burdwan and University of Calcutta respectively. He received his PhD from Institute for Plasma Research, Gandhinagar, Gujarat in March 2016 under the supervision of Prof. Prabal Kumar Chattopadhyay.

His research interest involves helicon plasma thruster, Localized electron heating due to Landau damping of helicon Wave, formation of multiple potential structures in plasma, various plasma experiments including tokamaks, physics of positron beam interactions with molecules.

Lecture-1: Turbulent Heating in Space Plasmas: Theory and Observation

Riddhi Bandyopadhyay

Department of Astrophysical Sciences, Princeton University, Princeton, NJ, 08540-7219, USA

The majority of naturally occurring flows are considered to exist in turbulent state. Due to the non-linear interaction of the structures, a turbulent system transfers energy from large scales to small scales and dissipates into heat. At intermediate length scales, the energy is mostly transferred from larger scales to smaller scales progressively, without any loss of energy. This process is known as the *energy cascade*. Turbulent energy cascade and dissipation have significant effects on transport of charged particles and heating. However, the nature of energy dissipation is not well understood in magnetized plasmas and fluids. Several mechanisms have been proposed as possible candidates of energy dissipation in these systems. Examples include magnetic reconnection, Landau damping, damping of waves, heating by microinstabilities. All these kinetic processes can contribute to plasma heating and particle energization. A complementary point of view is to focus on the energetics, and on general formulations that subsume, in principle, all available mechanisms. From this perspective, an important question is how to quantitatively estimate the energy transfer and dissipation rates across scales, on average. This talk will address this and other related questions, with a focus on the heliospheric plasmas, although the same understandings apply in other turbulent flows in laboratory, geophysical, and astrophysical systems.

Lecture-2: Bound Positron-Molecule Annihilation Resonances

Soumen Ghosh*

Department of Physics, University of California, San Diego, La Jolla, CA 92093-0319, USA

Nonneutral plasma physics techniques have enabled new types of tunable, high-energy-resolution positron beams. Exploiting these advances, I will talk about bound positron-molecule annihilation resonances with modes other than fundamental vibrations. Low energy positrons (< 0.5 eV) bind to molecules through Feshbach resonant excitation of dipole- or quadrupole-active fundamental vibrational modes, and this leads to greatly enhanced annihilation rates. Recently, new annihilation resonances were observed involving vibrational modes beyond the fundamentals. These new resonances appear to be due to combinations and/or overtones of the fundamental vibrations. They have considerable importance, for example, for understanding the physics of positron annihilation in the interstellar medium. In the course of this discussion, I will describe the process of generating slow positrons (1 - 100 eV) using a radioactive source (energies of 100's of keV) and trapping and cooling them to room temperature or below. The application of this cold beam to the study of resonant annihilation with molecules will be discussed.

* *In collaboration with J. R. Danielson and C. M. Surko, and funding supported by US NSF grant PHY1702230 and PHY-2010699.*

Dr. Parvez N. Guzdar

Dr. Parvez Nariman Guzdar was born in Kolkata and grew up there. He attended St. Xavier's college and Calcutta University, and joined Physical Research Laboratory, Ahmedabad for his Ph.D. research. In 1976, he moved to Princeton University to pursue post-doctoral work and later joined the Plasma Physics Programme, which became the Institute for Plasma Research (IPR). He, later, moved to the University of Maryland and worked there for the rest of his research career. He was a frequent visitor to the Institute for Plasma Research and other research institutes in India.

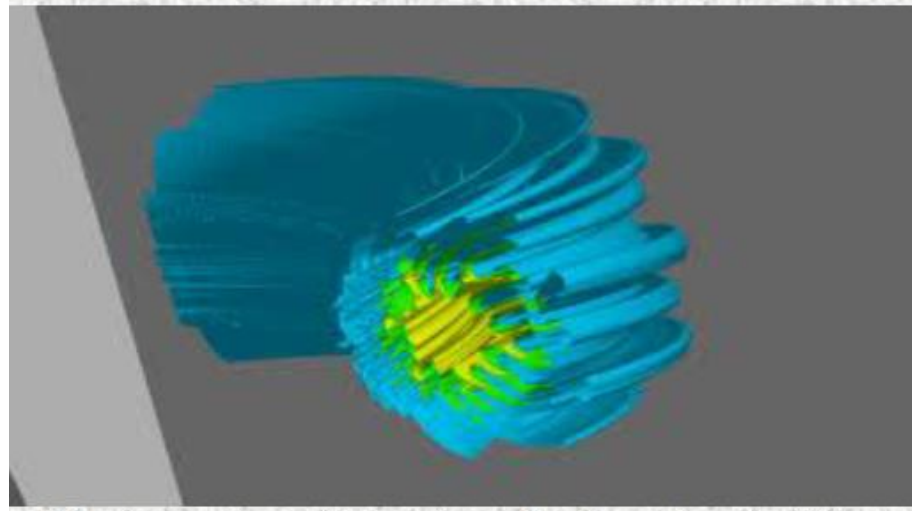
Dr. Guzdar was an outstanding scientist, well known internationally for his seminal contributions in many areas of plasma physics ranging from fundamental studies of plasma instabilities to novel applications and interpretation of experimental phenomena in magnetic fusion devices, laser fusion, space and astrophysical plasmas and various nonlinear systems.

A man of many talents, Dr. Guzdar enjoyed playing the piano, sports, travelling, reading and visiting museums. His passion for learning and knowledge was exceptional, matched only by an even greater passion, namely, generosity in helping others. His generous spirit and compassion were his best qualities, and made him truly loved by all of those around him.

Parvez Guzdar Award

About the Award

To honor the memory of Dr. Parvez N. Guzdar, his family and friends have contributed towards a corpus fund created at the Institute for Plasma Research to institute an award. The award consists of a cash prize of Rs. 50,000/- and a citation and will be given annually to a selected Indian Scientist below the age of 35 years who has made significant research contributions in the field of plasma physics and controlled thermo nuclear fusion.



The figure above (taken from Dr. Guzdar's scientific publication) shows three-dimensional isosurfaces of the pressure as the instability develops along ridges dominantly aligned along the ambient magnetic field.