

Princeton Center for Theoretical Science

The Princeton Center for Theoretical Science is dedicated to exploring the frontiers of theory in the natural sciences. Its purpose is to promote interaction among theorists and seed new directions in research, especially in areas cutting across traditional disciplinary boundaries.

The Center is home to a corps of Center Postdoctoral Fellows, chosen from nominations made by senior theoretical scientists around the world. A group of senior Faculty Fellows, chosen from science and engineering departments across the campus, are responsible for guiding the Center. Center activities include focused topical programs chosen from proposals by Princeton faculty across the natural sciences. The Center is located on the fourth floor of Jadwin Hall, in the heart of the campus “science neighborhood”. The Center hopes to become the focus for innovation and cross-fertilization in theoretical natural science at Princeton.

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To find out more about Center Postdoctoral Fellowships and Programs see:

<https://pcts.princeton.edu>



Synergistic approaches to particle transport in magnetized turbulence: from the laboratory to astrophysics

April 15-17, 2024
Room 407, Jadwin Hall

Organizers

David Hosking, Philipp Kempfski, Vinicius Duarte,
Robert Ewart, Rajsekhar Mohapatra,
Arno Vanthieghem, Muni Zhou, Matthew Kunz,
Eliot Quataert, Anatoly Spitkovsky

Synergistic approaches to particle transport in magnetized turbulence

Monday, April 15, 2024 – Thermal Particle Transport

- 8:30 Coffee & light breakfast at PCTS
- 9:00-9:15 **Welcome/Introduction**
- 9:15-9:45 **Archie Bott**
Firehose-induced collisionality
- 9:45-10:15 **Evan Yerger**
An effective collision operator for whistler turbulence
- 10:15-10:45 **James Drake**
A self-consistent model of electron scattering by oblique whistler waves in high beta plasma relevant to galaxy clusters
- 10:45-11:15 Coffee Break at PCTS
- 11:15-11:30 **Martin Laming**
The first ionization potential effect in the solar corona and wind
- 11:30-11:45 **Amitava Bhattacharjee**
Relaxation of weakly collisional plasmas and galaxies
- 11:45-12:00 **Uddipan Banik**
Relaxation of weakly collisional plasmas: decaying echoes and transition to the fluid limit
- 12:00-12:15 **Robert Ewart**
Universal collisionless equilibria
- 12:15-1:15 Lunch at PCTS
- 1:15-2:15 **Tutorial: Felix Parra Diaz**
Gyrokinetics for thermal particle transport in toroidal magnetic confinement devices
- 2:15-2:30 Coffee Break at PCTS

Monday, April 15, 2024 – Particle Acceleration

- 2:30-2:45 **Rebecca Diesing**
From microphysical theory to multi-messenger observations: a semi-analytic approach to diffusive shock acceleration
- 2:45-3:00 **Mikhail Medvedev**
What do Weibel filaments do in the shock upstream?
- 3:00-3:15 **Poster Lightning Talks**
- 3:15-3:30 Coffee Break at PCTS
- 3:30-3:45 **Hantao Ji**
Non-thermal electron acceleration by magnetically driven reconnection at low beta using laser-powered capacitor coils
- 3:45-4:00 **Luca Orusa**
Ion acceleration in 3D hybrid simulations of quasi-perpendicular shocks
- 4:00-4:15 **Xiaochen Sun**
Particle acceleration in highly magnetized turbulence
- 4:15-5:15 **Panel Discussion:** Matt Kunz, Greg Hammett, Alex Schekochihin, Jena Meinecke, Jim Drake
- 5:15 -7:00 Welcome Reception at PCTS

Tuesday, April 16, 2024 – Particle Acceleration (cont.)

- 8:30 Coffee & light breakfast at PCTS
- 9:00-10:00 **Dmitri Uzdensky**
Relativistic nonthermal particle acceleration in collisionless magnetized plasma turbulence
- 10:00-10:30 **Jena Meinecke**
Strong suppression of heat conduction in a laboratory replica of galaxy-cluster turbulent plasmas
- 10:30-11:00 Coffee break at PCTS

Synergistic approaches to particle transport in magnetized turbulence

Tuesday, April 16, 2024 – Particle Acceleration (cont.)

- 11:00-12:00** **Jack Hare: Astrophysics Colloquium, Peyton Hall and streamed at PCTS**
- 12:00-1:00** **Lunch at PCTS**
- 1:00-1:30** **Tünde Fülöp**
Chasing runaways armed with snowballs
- 1:30-2:00** **Takanobu Amano**
Electron injection via stochastic shock drift acceleration at quasi-perpendicular shocks
- 2:00-2:30** **Lorenzo Sironi**
Particle acceleration in spider pulsars and GRB afterglows
- 2:30-3:00** **Coffee Break at PCTS**
- 3:00-3:30** **Damiano Caprioli**
Kinetic simulations of self-generated cosmic ray diffusion
- 3:30-4:00** **Frederico Fiuza**
Energy partition and electron acceleration in turbulent collisionless shocks
- 4:00-5:00** **Panel Discussion:** Martin Lemoine, Takanobu Amano, Frederico Fiuza, Lorenzo Sironi, Damiano Caprioli, Tünde Fülöp

Wednesday, April 17, 2024 – High Energy Transport

- 8:30** **Coffee & light breakfast at PCTS**
- 9:00-10:00** **Ellen Zweibel**
Fluid Models for Cosmic Ray Interactions and Transport
- 10:00-10:15** **Rouven Lemmerz**
Towards a deeper understanding of cosmic ray-driven instabilities and their saturation

Wednesday, April 17, 2024 – High Energy Transport (cont.)

- 10:15-10:30** **Silvio Sergio Cerri**
Revisiting the turbulent damping of cosmic-ray driven Alfvén waves
- 10:30-11:00** **Coffee Break at PCTS**
- 11:00-11:30** **Martin Lemoine**
Particle transport in magnetized turbulence: a role for structures
- 11:30-12:00** **Siyao Xu**
Mirror diffusion of cosmic rays
- 12:00-12:15** **Iryna Butsky**
Galactic cosmic-ray scattering due to intermittent structures
- 12:15-1:15** **Lunch at PCTS**
- 1:15-1:45** **Patrick Reichherzer**
Cosmic ray transport in galaxy clusters: from GeV to EeVs
- 1:45-2:00** **Benedikt Schroer**
Saturation of the resonant streaming instability and the role of damping
- 2:00-2:15** **Ka Ho Yuen**
Cosmic ray diffusion and heating due to asymmetric resonance broadening
- 2:15-2:45** **Yashika Ghai**
Role of energetic particle physics for burn performance of a reactor-level fusion device
- 2:45-3:15** **Coffee Break at PCTS**
- 3:15-3:45** **Jeff Lestz**
Emergence of a quasilinear transport theory for near-threshold energetic-particle-driven instabilities

Synergistic approaches to particle transport in magnetized turbulence

Wednesday, April 17, 2024 – High Energy Transport (cont.)

- 3:45-4:00 **Thomas Foster**
Orbits of energetic particles around rational flux surfaces in stellarators
- 4:00-5:00 **Panel Discussion and Conclusion**
Ellen Zweibel, Siyao Xu, Jeff Lestz, Yashika Ghai