Contribution ID: **28** Type: **Contributed talk in mini symposium**

Towards a unified picture of energy partition in high Alfvén Mach number collisionless shocks

Wednesday, 13 December 2023 14:55 (12 minutes)

Collisionless shock waves shape the nonthermal emission in a wide range of environments, including modern laboratory experiments and astrophysical outflows. In weakly magnetized plasma flows, self-generated nonlinear electromagnetic plasma processes are inferred to heat and accelerate electrons and ions. Understanding the mechanisms that underpin the energy transfer between plasma species and the downstream temperature ratio between electrons and ions constitutes a fundamental challenge in modeling such blast waves. In this presentation, I will outline recent efforts to model the transport of electrons in Weibel-mediated shocks. I will introduce a new model accounting for electron heating in an ambipolar-type process through the interplay between pitch-angle scattering in the microturbulence and the coherent electrostatic field induced by the difference in inertia between species. Via analytical kinetic and fluid estimates, a semi-analytical Monte Carlo-Poisson method, and large-scale ab-initio Particle-In-Cell simulations, I will discuss the electron-ion energy partition in the downstream of high Alfvén Mach numbers shocks relevant to supernova remnants and laboratory experiments. I will then present the extension of this model to the relativistic regime to demonstrate equipartition inferred from the afterglow emission of gamma-ray bursts. Finally, I will explore the implications of this model on electron injection in nonthermal distributions.

Primary author: VANTHIEGHEM, Arno (Princeton University/NINS)

Co-authors: Prof. SPITKOVSKY, Anatoly (Princeton University); Prof. FIUZA, Frederico (Instituto Superior Técnico, Lisbon); Prof. SEKIGUCHI, Kazuhiro (NINS); Prof. GREMILLET, Laurent (CEA); Prof. LEMOINE, Martin (Institut d'Astrophysique de Paris); Mr TSIOLIS, Vasileios (Princeton University); Prof. TOHDO, Yasushi (NIFS)

Presenter: VANTHIEGHEM, Arno (Princeton University/NINS)

Session Classification: Plasma Astrophysics