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INVITED SPEAKER: The role of kinetic scales: particle acceleration from shocks and reconnection

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Abstract content
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Non-thermal particles are ubiquitous in astrophysics, but by their very nature can not be described by fluid approximations and require a more detailed description on the kinetic scale. To understand the dynamics it is necessary to study the processes responsible for acceleration and transport of these particles.

The interplay of particle distributions and fields is too complex for an analytic, self-consistent description as they are non-linearly coupled so computer simulations are required. Typically computer models for kinetic plasmas try to solve the Vlasov equation by either representing the distribution function of energetic particles as fields on a grid or via pseudo-particles. This talk focusses on the popular Particle-in-Cell method, where the plasma is represented by pseudo-particles interacting with a grid based electromagnetic field.

While PiC is used for many problems in kinetic plasmas, we focus on the two kinds of acceleration mechanisms, that are most likely responsible for the major fraction of all energetic particles observed in space: Shock fronts and reconnection events. It will be especially highlighted, how to handle the large gap of length scales between the kinetic plasma scales and the outer scales of astrophysical objects.

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