Plenary Talk PV VII Thu 9:00 ELP 6: HS 3+4

Progress in solar flare modeling — •Rony Keppens — Centre for mathematical Plasma Astrophysics, KU Leuven, Belgium

A violent plasma process to study is the solar flare, which represents the most energetic explosion in our heliosphere. It involves a dramatic change - or reconnection - in the magnetic topology of the atmosphere, and the so-called "standard solar flare model" collects all observationally established info on flares in a cartoon. This cartoon emphasizes that macroscopic (magnetohydrodynamic) and microscopic (energetic particles) plasma physical processes dynamically interact, although most model efforts only simulate the large magnetohydrodynamic (MHD) or the small (kinetic) scales. I will present our first self-consistent model of a standard solar flare, where electron beam physics dynamically couples to a large-scale, multi-dimensional magnetohydrodynamic evolution of a flaring arcade. By varying the magnetic field strength, we explore the various flare classes, and we can compare with 1D flare models to point out the multi-dimensional aspects they lack. We continued simulating the hour-long postflare behaviour, to ensure that the hot meets the cold: the first numerical demonstration of postflare coronal rain due to thermal instability! I will also show recent results on full 3D standard flare modeling, where we obtained Kelvin-Helmholtz induced turbulent looptops consistent with observed non-thermal broadenings, and where we find clear multi-phase behaviour in the gradual phase. All simulations use our open-source MPI-AMRVAC toolkit [amrvac.org], where grid-adaptivity is essential to zoom in on details that can be resolved by future observing facilities.