

Smoothed Particle Magnetohydrodynamics: The state of the art

Daniel PRICE

Monash Centre for Astrophysics (MoCA) and School of Mathematical Sciences Monash University,

I will discuss recent exciting developments in the Smoothed Particle Magnetohydrodynamics algorithm. In particular, we have recently developed a robust divergence cleaning algorithm that solves many of the problems associated with earlier approaches to maintaining the divergence-free character of the magnetic field in SPH. This, combined with other improvements, means that we are now able to robustly simulate many complex problems. I will show some examples of these, including the magnetically-driven launch of jets during the star formation process and fast magnetic dynamos in driven, supersonic turbulence. Finally, I will discuss some general issues related to two-fluid algorithms that we have discovered in the context of dust-gas mixtures, which are relevant to more general two-fluid approaches to plasma physics.