

## O4.402 On the influence of particle acceleration on the structure of low-Mach astrophysical shocks

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See the full abstract here <http://ocs.ciemat.es/EPS2019ABS/pdf/O4.402.pdf>

Cosmic rays are charged particles, moving at relativistic speeds after being accelerated through interaction with astrophysical shocks. This process, known as diffusive shock acceleration, or Fermi acceleration, involves the particle repeatedly crossing the shock, picking up speed each time it is reflected by the local magnetic field. So far, computer models of this particle-shock interaction have focussed primarily on high-Mach shocks, such as supernovae and stellar wind collisions. Here we concentrate instead on low-Mach shocks, such as those that occur when galaxy clusters collide. These shocks are characterised by a combination of a low sonic-Mach number and a high plasma-beta. Previous results showed that these shocks are capable of accelerating particles and may contribute to the cosmic ray spectrum. We now continue this work using a combined particle-in-cell (PIC) and magnetohydrodynamics (MHD) approach. This involves splitting the plasma into two components. The first, which comprises the majority of the local plasma behaves as a thermal plasma and can be simulated using MHD. The second, much smaller component behaves nonthermally and is modelled using PIC. The two components interact self-consistently with each other through the local electromagnetic field. This approach allows us to simulate a much larger physical volume than would be possible with the more traditional PIC-only approach. Our results show that for these low-Mach, high-beta shocks, the particle acceleration process has a significant influence on the local plasma. Local instabilities, triggered by the interaction between the non-thermal particles and the magnetic field, change both the Mach-number of the shock, as well as the angle between the shock surface and the magnetic field to the point where it may well inhibit the injection of non-thermal particles into the local medium, effectively cutting off the acceleration process.

**pppo**

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