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Spectrally resolved cosmic rays in galaxy simulations

Summary

What is this contribution about?

We investigate the dynamical impact of CRs on the evolution of galaxies, in particular the star formation rate, the shape of the disc and the CR-driven outflows.

Why is it relevant / interesting?

The impact of CRs is highly relevant for the star formation history of galaxies and the mass loss due to winds and outflows. In order to explain the observed outflow properties and the low overall efficiency of star formation is a closely connected to CRs.

What have we done?

We include CRs into magneto-hydrodynamical simulations by dynamically coupling them to the thermal and magnetic gas self-consistently. We include spectrally resolved CRs from 10 MeV up to TeV in the advection-diffusion approximation. The full spectrum in every computational cell allows us to accurately account for CR cooling and compute the CR pressure impact precisely. The energy-dependent diffusion can be properly addressed by varying diffusion coefficients.

What is the result?

Our simulations show that spectrally resolved CRs reduce the star formation rate and at the same time increase the outflow rate from star forming regions in the galaxy. The spectral analysis shows that mainly the energy regime between 10 and 30 GeV drives galactic outflows.