universität innsbruck

Studying Numerical Cosmic-Ray Acceleration

Subject Numerical Simulations, Cosmic-Ray Acceleration

Supervisor Ralf Kissmann

Contact Ralf.Kissmann@uibk.ac.at

The majority of cosmic rays are thought to be accelerated via so-called Fermi acceleration, the repeated scattering of charged particles over a shock front. In the computational astro-particle physics group, we simulate this process by numerically solving the cosmic-ray transport equation with the shock front being described in the context of a code for the evolution of astrophysical plasmas. In this bachelor thesis, we will evaluate extensive tests of a new momentum solver for the particle transport problem. The aim is to quantify the numerical errors by comparing to analytical solutions of the cosmic-ray acceleration problem at one-dimensional shocks. On the one hand, the impact of resolution in space and momentum will be quantified. On the other hand, different energy-loss processes will be taken into account to study the change of the spectrum in the presence of these processes. At this point, it will also be interesting to study which configuration of the solver will be most efficient for solving the transport problem in the presence of energy losses.