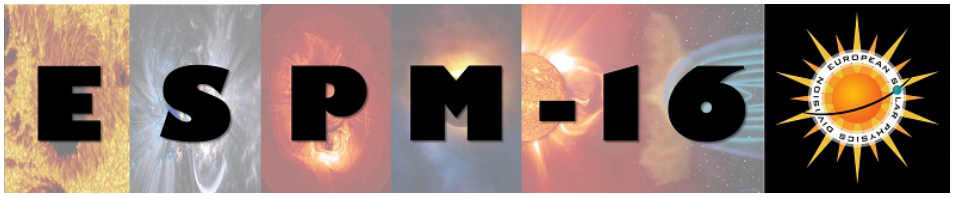

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Public version of Mancha: a non-ideal MHD code for realistic simulations of the solar atmosphere.

Wednesday, 8 September 2021 09:26 (13 minutes)

The MANCHA code development was started in 2006 to study wave dynamics in sunspots at the Instituto de Astrofísica de Canarias.
Since then it has gradually been upgraded by adding new physics and improved programming techniques.
The code can be used for a large variety of problems from linear wave propagation and classical hydrodynamic instabilities to highly realistic simulations of convection-driven solar and stellar atmosphere.

The code solves the MHD equations including nonlinear terms for the ambipolar and Hall diffusion, the Ohm's heating and the Biermann battery.
The radiative energy exchange is implemented by the short-characteristics method.
The equation of state is either ideal (computed on the fly) or realistic (interpolated from pre-computed lookup tables provided by the user).
The code uses uniform Cartesian grid with spatial discretization up to 6th order; the Runge-Kutta scheme is used for the time integration.
A super-time-stepping technique is implemented to overcome timestep limitation due to diffusion processes.
Hyper-diffusion and filtering are available to stabilize the high-frequency numerical noise.
A perfectly-matched-layer is implemented as an optional non-reflecting boundary condition.
MANCHA is written in Fortran and parallelized with MPI, including parallel I/O using the HDF library.

In order to solve a new problem, users will need to find their own optimal set of parameters in an input control file.
In the case of non-periodic boundaries, users are expected to create their own boundary condition module.
A set of samples together with the manual provide basic instructions on how to do that.

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