3D Spectral Radiative Transfer and perspectives for spectroscopic diagnostics

Laurent Ibgui[*1], Ivan Hubeny[2], Thierry Lanz[3], Matthias González[4], Chantal Stehlé[1], Salvatore Colombo[1,5,6], and Salvatore Orlando[6]

[1]LERMA (Laboratory for Studies of Radiation and Matter in Astrophysics and Atmospheres), Paris Observatory, Sorbonne University, École Normale Supérieure (ENS), Cergy-Pontoise University, CNRS, France

[2]Steward Observatory, University of Arizona, Tucson, AZ, USA

[3]Côte d'Azur Observatory, Nice, France

[4]Paris Diderot University, AIM, CEA, CNRS, France

[5]Università di Palermo, Italy

[6]INAF - Osservatorio Astronomico di Palermo, Italy

Abstract

As 3D (radiation) magnetohydrodynamic models (RMHD) are starting to emerge in various domains of theoretical astrophysics, – e.g., accretion columns and jets in young stellar objects, protoplanetary discs, stellar and planetary atmospheres – it is becoming important to be able to test these 3D models by comparing their predicted spectroscopic signatures with observations.

To this end, the three-dimensional spectral radiative transfer code IRIS has been specifically designed to post process RMHD 3D simulations, in order to provide emissivity maps and synthetic spectra. I will describe the numerical features that are currently implemented in this code that is still under development. I will detail the first applications of IRIS, which was used to post-process laboratory radiating shocks 3D RHD simulations performed with the HERACLES code. IRIS could assess the validity of the approximate model M1 used for the treatment of radiation coupled with hydrodynamics. It could also evaluate the spatial, angular, and spectral distribution of the radiation that emerges from the radiating shock.

I will finally summarize the future prospects considered for IRIS, in particular the characterization of spectral signatures of accreting flows onto young stellar objects.

[*]Speaker