MHD winds in protoplanetary discs undergoing a stellar flyby: the case of AS 205

Elisa M. Castro Martínez[1], Nicolás Cuello[1], Daniel J. Price[2], Nicolás T. Kurtovic[3], Miguel Vioque[4], Geoffroy Lesur[1], Gaylor Wafflard-Fernandez[1], Antoine Alaguero[1], and Philippe Delorme[1]

[1] *Univ. Grenoble Alpes, CNRS, IPAG, 38000 Grenoble, France*
[2] *School of Physics and Astronomy, Monash University, Clayton VIC 3800, Australia*
[4] *European Southern Observatory, Karl-Schwarzschild-Strasse 2, D- 85748 Garching bei München, Germany*
[3] *Max-Planck-Institut für Astronomie, Königstuhl 17, 69117 Heidelberg, Germany*

Recent surveys of young stellar regions have shown that magnetically driven winds (MHD winds) are ubiquitous among Class II objects. Population-level studies have revealed correlations between accretion and outflow processes, suggesting a common physical origin of winds across young stellar systems. However, protoplanetary discs are often subject to perturbations, such as planets, close companions, and stellar flybys, which can significantly affect the structure of the disc and potentially impact the properties of MHD winds.

An example of this is AS 205 N, a highly perturbed disc undergoing a flyby involving the AS 205 S spectroscopic binary. Some studies have reported signatures of winds and a jet originating from AS 205 N. However, it remains unclear whether the ongoing flyby may contaminate these signals and thus bias their interpretation, or physically alter the accretion-ejection processes, potentially making the system unrepresentative from a population perspective.

In this work, we investigate how external perturbations influence the structure and efficiency of MHD winds. We focus on the case of AS 205, by first constraining the orbital parameters of the flyby and initial disc properties inferred from the gas morphology using hydrodynamical simulations with the code Phantom. These results were used to initialise three-dimensional global magnetohydrodynamic simulations with the code Idefix. We analyse the properties of the winds arising from the disc under the influence of the flyby, and contrast them with observations of the system.

The results of this investigation improve our understanding of the impact of external perturbers on the structure and observational signatures of MHD winds, and help assess whether flybys may bias their interpretation in observed systems. This preliminary work will constitute the foundation for a more general framework to interpret observational signatures of MHD winds in perturbed environments, as well as the underlying physical processes governing them.