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Formation of structures due to the presence of planets in the discs of young solar-like stars.

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Abstract

Forming planets around young, fast-rotating solar-like stars are exposed to strongly magnetized stellar winds, as a consequence of the enhanced magnetic activity of these stars. In addition to the action of these winds, transient energetic events such as coronal mass ejections (CMEs) are believed to be frequent in these environments, increasing the density, velocity, and magnetic field of the background stellar wind. The interaction of winds and CMEs with orbiting planets around active stars may lead to the formation of observable signatures due to the formation magnetic field and density disturbances in the vicinity these planets, such as comet-like tails or large bow-shocks, and may play a fundamental role in shaping the geometry of the possible present young planetary atmospheres. In this work, we study the interaction between the stellar winds and CMEs of very active, young stars with planetary obstacles through numerical 2.5D simulations using the PLUTO MHD code. The case of study is AB Doradus, a nearby young star, with a small rotation period (0.51 days) and a strong flaring activity. From these simulations, we characterize the formation of density and magnetic field disturbances in the vicinity of the planetary obstacles for different stellar wind configurations, in the case of close-in Earth-like planets. These results may contribute to the study of the temporal variability in UV and sub-mm ranges in young-protoplanetary discs due to the presence of planets.

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