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FU Orionis: a case study for understanding the formation of complex substructures within protoplanetary disks of eruptive stars

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FUors are a class of eruptive pre-main sequence stars surrounded by protoplanetary disks (PPDs) known for undergoing decade-long outbursts of uncertain origin capable of increasing their luminosity by several orders of magnitude. These outbursts are expected to highly influence the dynamics of PPDs and planet formation, and could potentially explain the low-luminosity problem of PPDs. The study of the prototype for FUors, the binary star FU Orionis, is of major interest since in 2016 spiral arms were identified within the PPD of the northern star with the SUBARU telescope, but it is still unknown if they are somehow related to the outburst of the star recorded in 1937. In this article, we present for the first time the direct detection of a counterclockwise rotation for the northern PPD by using observations taken by the Very Large Telescope ranging from 2016 to 2024, which in combination with the measurements of the kinematics of the spiral arms will allow us to determine if these substructures are related to the 1937 outburst, constrain the scenarios that can replicate the current aspect of the system, and compute accurately the mass of the northern star, which to date has only been estimated.

Primary author(s) : Mr MONTOYA CALDERÓN, Erick (Millennium Nucleus YEMS and Universidad de Santiago de Chile)

Co-author(s) : Dr PÉREZ, Sebastián (Millennium Nucleus YEMS and Universidad de Santiago de Chile)

Presenter(s) : Mr MONTOYA CALDERÓN, Erick (Millennium Nucleus YEMS and Universidad de Santiago de Chile)

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