Large-scale CO Spiral Arms and Complex Kinematics Associated with the T Tauri Star RU Lup

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We obtained deep ALMA images of CO around RU Lup, a T Tauri star located 159 pc away in the Lupus II cloud. RU Lup's complex gas spiral structures and kinematics, in conjunction with its famed photometric variability and elevated stellar accretion rates, are reminiscent of FU Ori outbursts observed in earlier embedded stages.

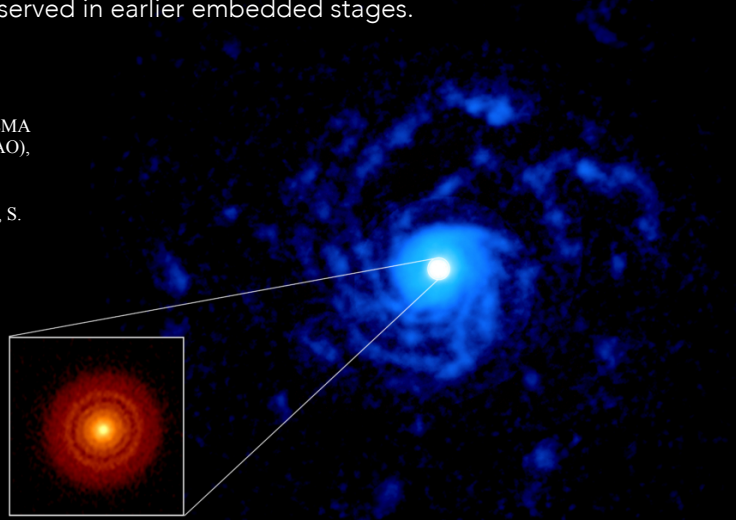
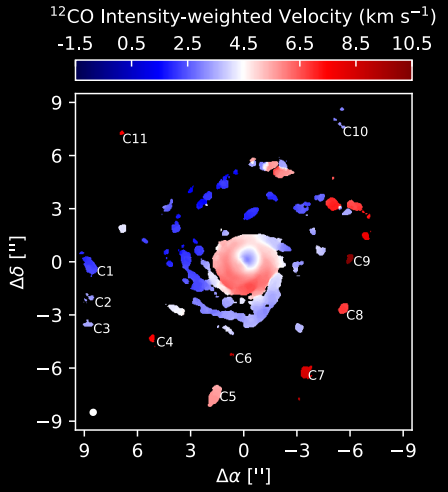
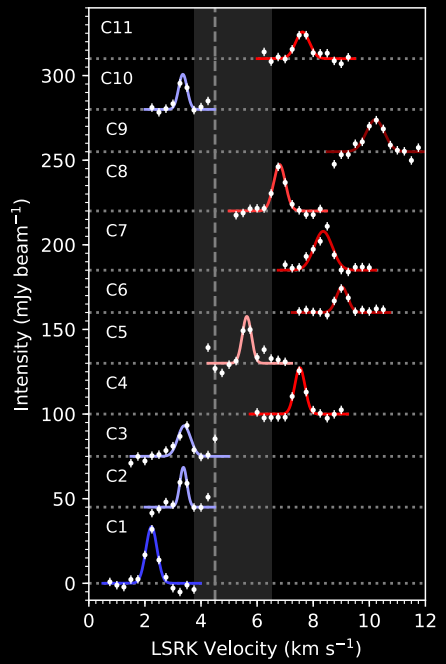


Image Credit: ALMA (ESO/NAOJ/NRAO), J. Huang and S. Andrews; NRAO/AUI/NSF, S. Dagnello





^{12}CO *J=2-1* emission (blue) reveals multiple spiral arms stretching out to ~1000 au from the star, presenting a striking contrast with the compact, axisymmetric 1.25 millimeter continuum imaged by DSHARP (orange).

The spiral arms are largely blueshifted from the Keplerian disk. We also detect multiple marginally resolved clumps of CO emission exterior to the spiral arms across a range of LSRK velocities.

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