PROTOPLANETARY DISKS

Hierarchical hoopla

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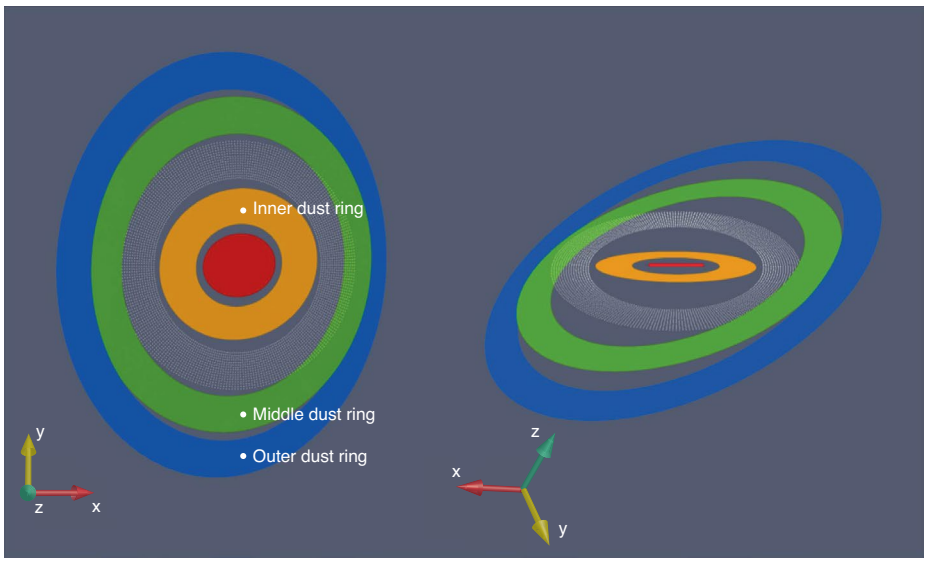

Credit: AAS

Stars are now known to form frequently in multiple systems, but triple systems — particularly triples close enough to study well with the Atacama Large Millimeter/submillimeter Array (ALMA) — are still rare. Jiaqing Bi and collaborators have focused ALMA on a known hierarchical triple system, GW Ori, finding that it is surrounded by three circumstellar (indeed, circumtriple) rings, none of which share a plane. The outer annulus, massive enough to account for 245 Earths, has a semimajor axis of 338 au, making it the largest known dust-ring component of a protoplanetary disk.

ALMA 1.3 mm continuum images show three marginally elliptical rings, at ~46, 188 and 338 au, while the gas disk (observed in CO $J = 2–1$ emission) extends to ~1,300 au. Analysis of the CO first-moment map reveals a twisted element at small scales, indicative of an inner-ring/outer-rings misalignment. Kinematic modelling of the CO emission reinforces the premise that the rings are likely to be misaligned, and dust continuum models generate reasonable synthetic visibilities for nested dust rings of differing eccentricities and position angles. Adopting a clockwise orbital motion allows Bi et al. to break the degeneracy involved in determining the relative inclinations between the rings and put forward the schematic shown in the image, with ring inclinations of ~11, 35 and 40°, respectively (inner–outer).

The ~140 au gap between the inner and middle ring where the disk 'breaks' is the most interesting part of the system: does the gap contain a companion? Did this companion produce the inferred misalignment? Follow-up studies are needed.

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