Colloquium

SFB 956

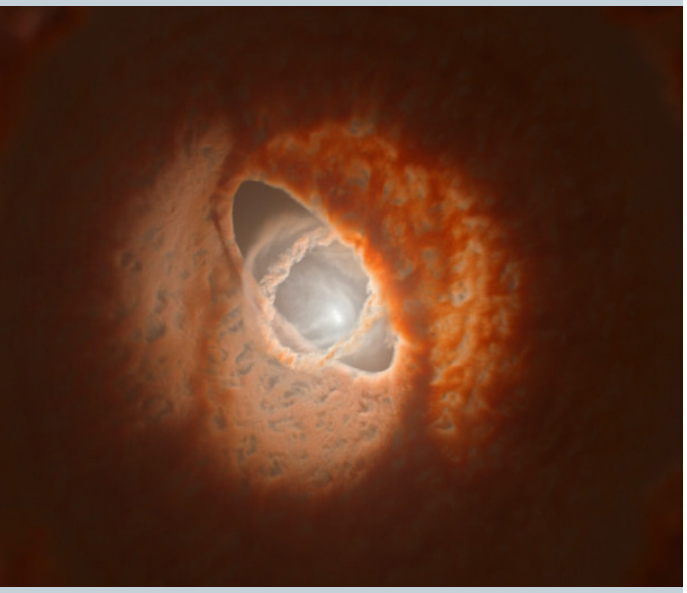
Conditions and Impact of Star Formation

1 February 2021

Monday 3:30 pm

Physikalische Institute Köln

Video stream / Host: Peter Schilke



Stefan Kraus

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GAIA-BIFROST: Formation and Architecture of Star and Planetary Systems

Most stars do not exist alone but are orbited by planets or stellar-mass companions. One of the big open questions concerns how planetary systems and multiple-star systems form and what causes the diversity in their orbital characteristics. For instance, the orbits of many Hot Jupiters are tilted with respect to the stellar spin axis, indicating that these planets formed in the outer disk and were then transported onto oblique orbits through dynamical interactions.

In this talk, I will outline how infrared interferometry allows us to explore the origin of the diversity that we see in star and planetary systems. I will discuss results from our MIRCX six-telescope imager at CHARA, where we achieve the resolution of a 330m telescope and search for potentially planet-induced structures in the innermost astronomical unit of protoplanetary disks. In another study, we find evidence for the disk tearing effect, where the gravitational torque of companions on misaligned orbits tears the disk apart and moves disk material out of the disk plane, enabling planet formation on highly oblique orbits.

In the second part, I will present the ERC-funded GAIA-BIFROST project that will measure orbital parameters, precision masses, and spin-orbit alignments for thousands of binary and planetary systems. We will build a new beam-combination instrument for ESO's VLT Interferometer, named BIFROST, that will open the short-wavelength and high spectral-resolution window at VLTI. This will allow us to measure spin-orbit alignments for wide-separation planets, providing fundamentally new insights on the dynamical processes that shape system architectures.

Finally, I will outline the prospects of using BIFROST with the VLTI unit telescopes for the characterisation of exoplanet atmospheres. Combining star-light suppression from interferometry and adaptive optics, BIFROST will be able to probe closer-in planets than GRAVITY/GRAVITY+ and provide access to complementary molecular line tracers, probing deeper layers of the atmosphere.