The GRAVITY view of the innermost regions of protoplanetary disks

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Probing the inner rim of the protoplanetary disks where micron-sized dust grains grow to pebbles and larger bodies producing the first building blocks of planets, and investigating star-disk interactions at sub-astronomical unit scale are of utmost interest as they define the initial and environmental conditions for planet formation.

Since its installation in 2016, VLTI/GRAVITY has brilliantly illustrated the potential of the high angular and spectral resolutions to constrain these innermost regions of protoplanetary disks in the near-infrared K-band. With a sample of a hundred young stellar objects (YSO), from solar-like (namely the T Tauri) to high-mass YSO, the YSO GTO Large Program has gathered a large homogeneous data set allowing us to extend the Radius-Luminosity relation over more than 4 decades and to look for trends with the properties of the central star and the disk morphology (GRAVITY Coll. Perraut et al. 2019, 2021). We have investigated the origins of gaps in the innermost regions, measure (mis-)alignments between the inner and the outer disks over a sample of 20 transitional disks (Bohn, Benisty, Perraut et al. 2022), and tested proxies to investigate a potential evolutionary scenario between the different morphologies of the dusty disks. Thanks to its spectroscopic ability, GRAVITY has also led to the spatial resolution of the Hydrogen Br_gamma emitting regions around a sample of YSO, leading to the first resolution of the magnetospheric accretion regions around T Tauri stars (Bouvier, Perraut et al. 2020; GRAVITY Coll. Garcia-Lopez et al. 2020; GRAVITY Coll. Wojtczak et al. 2023).

In a near future, with its improved sensitivity and sky coverage, GRAVITY+ will drastically increase our sample: a more representative population of YSO, including the bulk of T Tauri stars in different star forming regions, will be reachable, as long as lower-mass young stars and younger embedded sources that would become observable with near-infrared interferometry for the first time. Combined within multi-technique and multi-wavelength campaigns, and with advanced radiative transfer and MHD simulations, the GRAVITY+ observations will be key to obtain a global picture of the inner parts of the protoplanetary disks.

In this talk, I will review the most striking results obtained with GRAVITY during its first 5 years of operation and illustrate the opportunities opened by GRAVITY+.