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PRESS RELEASE

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Young stellar objects: the source of gas emission around Herbig Ae/Be stars

Based on the articles

"Spatially resolving the hot CO around the young Be star 51 Ophiuchi" by E. Tatulli et al.,

and

"The origin of hydrogen line emission for five Herbig Ae/Be stars spatially resolved by VLTI/AMBER spectro-interferometry", by S. Kraus et al.

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This week, *Astronomy & Astrophysics* is publishing new high-resolution observations of the gas component surrounding six young stars with the AMBER/VLTI instrument (ESO, Chile). Astronomers were able to measure the spatial distribution of the hydrogen and CO gas emission in the inner disks around six Herbig Ae/Be stars. They found that the gas emission can clearly trace the infall of matter onto the star or the ejection of gas from the system.

This week, *Astronomy & Astrophysics* is publishing new observations with AMBER/VLTI of the gas component in the vicinity of young stars. An international team of astronomers led by E. Tatulli (Grenoble, France) and S. Kraus (Bonn, Germany) [1] used the unique capability of the VLT near-infrared interferometer, coupled with spectroscopy, to probe the gaseous environment of Herbig Ae/Be stars. These are young stars of intermediate mass (approximately 2 to 10 solar masses), which are still contracting and often show strong line emissions.

In recent years, young stars have been widely studied with near-infrared interferometers, allowing astronomers to study their close environment with high spatial resolution (see for example the A&A special feature on AMBER/VLTI first results, published in March 2007). So far, near-infrared interferometry has been used mostly to probe the dust that closely surrounds young stellar objects. However, dust is only 1% of the total mass of protoplanetary disks, while gas is their main component (99%) and may be responsible for the structure of forming planetary disks. High-resolution observations of emission spectral lines are then required to trace this gaseous component. Various processes have been proposed as the source of emission lines. For example, they might come from an accreting gaseous inner disk or might be due to either magnetospheric accretion processes or to a stellar wind. Most of these processes would take place close to the star (less than 1 AU), and are therefore not accessible with direct imaging facilities.

Using the capabilities of AMBER/VLTI, including milli-arcsecond spatial resolution [2], the team has now been able to trace the inner gaseous environment of six Herbig Ae/Be stars. They measured the geometry and position of the emitting regions surrounding these stars, for several diagnostic emission lines [3]. For two Herbig Be stars, they find that the emission line is probably associated with mass infall; in one case (51 Ophiuchi), the emission line could originate within a dust-free hot gaseous disk. In the other one (HD 98922), the emitting region is very compact and might originate from magnetospheric accretion, through which the material is transported from the disk to the stellar surface. For the four other Herbig Ae/Be stars that have been observed, the emission line would be related to mass outflow, with gas lifted from the surface of a circumstellar disk and then ejected from the stellar system.

Until now, the origin of the gas emission from these young stars was still being debated, because in most earlier investigations of the gas component, the spatial resolution was not high enough to study the gas distribution close to the star. Applying the new high-resolution feature of the AMBER instrument to gas emission observations, the team was then able to show that the gas emission can distinctly trace the physical processes acting close to the star.

[1] The team includes S. Kraus, K.-H. Hofmann, A. Meilland, N. Nardetto, T. Preibisch, D. Schertl, G. Weigelt (MPI, Bonn, Germany), E. Tatulli (INAF, Italy / Laboratoire d'Astrophysique de Grenoble, France), M. Benisty, J.-P. Berger, F. Malbet, F. Ménard (Laboratoire d'Astrophysique de Grenoble, France), O. Chesneau, P. Stee, (OCA, France), A. Natta (INAF, Italy), M. Smith (Univ. of Kent, UK), C. Gil, L. Testi (ESO), and S. Robbe-Dubois (Université de Nice, France).

[2] Observing the Moon with milli-arcsecond resolution, one should be able to distinguish details about 2 meters in size.

[3] They used the Brackett-γ line of hydrogen at 2.166 μm and the CO emission feature at 2.3 μm as diagnostic lines.

Spatially resolving the hot CO around the young Be star 51 Ophiuchi, by E. Tatulli, F. Malbet, F. Menard, C. Gil, L. Testi, A. Natta, S. Kraus, P. Stee, and S. Robbe-Dubois.

The origin of hydrogen line emission for five Herbig Ae/Be stars spatially resolved by VLTI/AMBER spectro-interferometry, by S. Kraus, K.-H. Hofmann, M. Benisty, J.-P. Berger, O. Chesneau, A. Isella, F. Malbet, A. Meilland, A. Nardetto, A. Natta, Th. Preibisch, D. Schertl, M. Smith, P. Stee, E. Tatulli, L. Testi, and G. Weigelt.

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Free version of the articles in PDF format: Tatulli et al. and Kraus et al.

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