First light for SPHERE exoplanet imager

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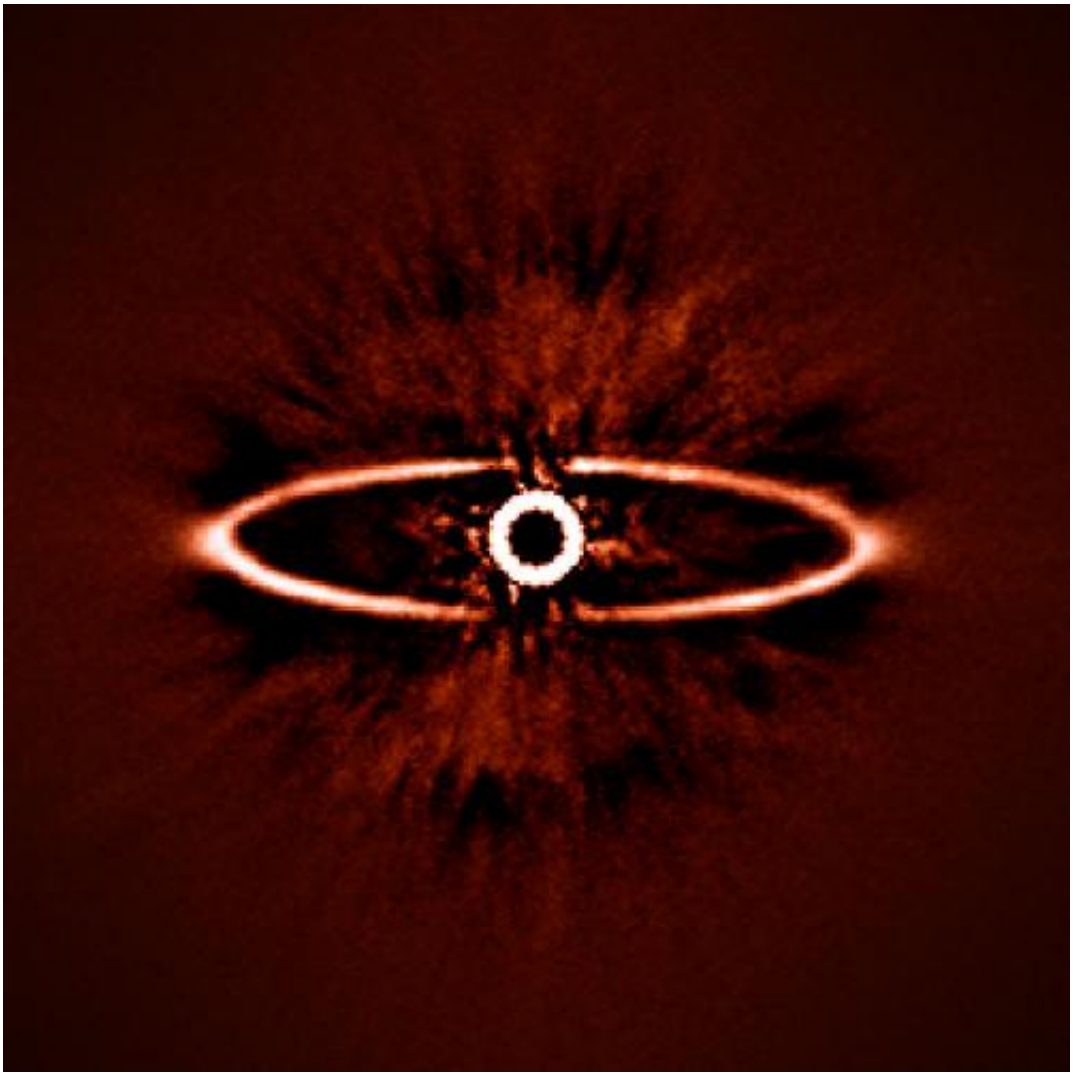

This infrared image shows the dust ring around the nearby star HR 4796A in the southern constellation of Centaurus. It was one of the first produced by the SPHERE instrument soon after it was installed on ESO's Very Large Telescope in May 2014. It shows not only the ring itself with great clarity, but also reveals the power of SPHERE to reduce the glare from the very bright star -- the key to finding and studying exoplanets in future. Credit: ESO/J.-L. Beuzit et

al./SPHERE Consortium

SPHERE—the Spectro-Polarimetric High-contrast Exoplanet REsearch instrument—has been installed on ESO's Very Large Telescope at the Paranal Observatory in Chile. This powerful facility for studying exoplanets uses multiple advanced techniques in combination. It offers dramatically better performance than existing instruments and has produced impressive views of dust discs around nearby stars and other targets during the very first days of observations. It is expected to revolutionize the study of exoplanets and circumstellar discs. Included is one of the best images so far of the ring of dust around the nearby star HR 4796A.

SPHERE passed its acceptance tests in Europe in December 2013 and was then shipped to Paranal. The delicate reassembly was completed in May 2014 and the instrument is now mounted on VLT Unit Telescope 3. SPHERE is the latest of the second generation of instruments for the VLT (the first three were X-shooter, KMOS and MUSE).

SPHERE combines several advanced techniques to give the highest contrast ever reached for direct planetary imaging—far beyond what could be achieved with NACO, which took the first ever direct image of an exoplanet. To reach its impressive performance SPHERE required early development of novel technologies, in particular in the area of adaptive optics, special detectors and coronagraph components.

"SPHERE is a very complex instrument. Thanks to the hard work of the many people who were involved in its design, construction and installation it has already exceeded our expectations. Wonderful!" says Jean-Luc Beuzit, of the Institut de Planétologie et d'Astrophysique de Grenoble, France and Principal Investigator of SPHERE.

SPHERE's main goal is to find and characterise giant exoplanets orbiting nearby stars by direct imaging. This is an extremely challenging task as such planets are both very close to their parent stars in the sky and also very much fainter. In a normal image, even in the best conditions, the light from the star totally swamps the weak glow from the planet. The whole design of SPHERE is therefore focused on reaching the highest contrast possible in a tiny patch of sky around the dazzling star.

The first of three novel techniques exploited by SPHERE is extreme adaptive optics to correct for the effects of the Earth's atmosphere so that images are sharper and the contrast of the exoplanet increased. Secondly, a coronagraph is used to block out the light from the star and increase the contrast still further. Finally, a technique called differential imaging is applied that exploits differences between planetary and stellar light in terms of its colour or polarisation—and these subtle differences can also be exploited to reveal a currently invisible exoplanet.

SPHERE was designed and built by the following institutes: Institut de Planétologie et d'Astrophysique de Grenoble; Max-Planck-Institut für Astronomie in Heidelberg; Laboratoire d'Astrophysique de Marseille; Laboratoire d'Etudes Spatiales et d'Instrumentation en Astrophysique de l'Observatoire de Paris; Laboratoire Lagrange in Nice; ONERA; Observatoire de Genève; Italian National Institute for Astrophysics coordinated by the Osservatorio Astronomico di Padova; Institute for Astronomy, ETH Zurich; Astronomical Institute of the University of Amsterdam; Netherlands Research School for Astronomy (NOVA-ASTRON) and ESO.

During the first light observations several test targets were observed using the many different modes of SPHERE. These include one of the best images so far of the ring of dust around the nearby star HR 4796A. It not only shows the ring with exceptional clarity but also illustrates how well SPHERE can suppress the glare of the bright star at the centre of

the picture.

Following further extensive tests and science verification observations SPHERE will be made available to the astronomical community later in 2014.

"This is just the beginning. SPHERE is a uniquely powerful tool andwill doubtless reveal many exciting surprises in the years to come," concludes Jean-Luc Beuzit.

Provided by ESO