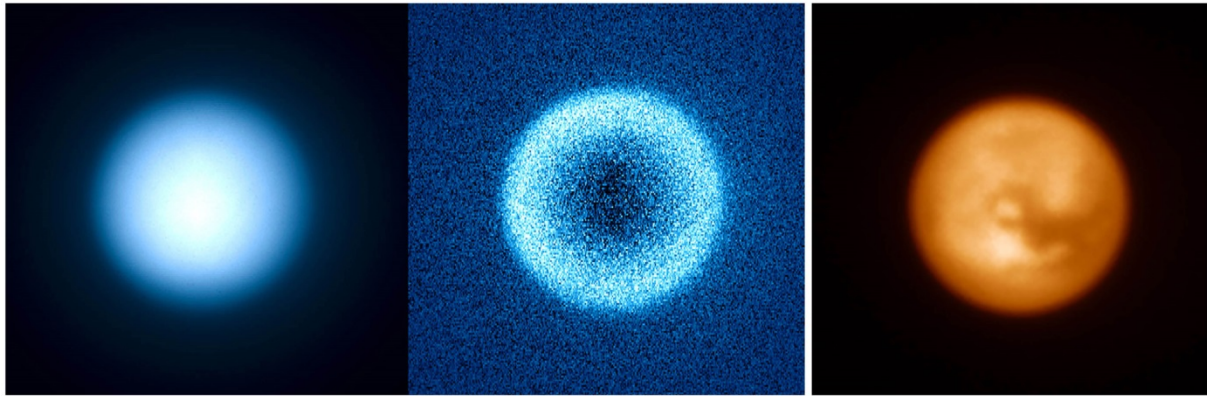


First light for SPHERE “VLT Planet Finder”

The new SPHERE „Planet Finder“ instrument has been installed at an 8m telescope of the Very Large Telescope (VLT) of the European Southern Observatory (ESO) in Chile. This new instrument for the imaging of extrasolar planetary systems uses much improved and novel technologies for high contrast imaging. It should provide for the European astronomers a competitive, if not the best observing facility for the imaging of extrasolar planets for the coming years. The instrument includes an extreme adaptive optics systems which corrects the image distortions introduced by the Earth atmosphere, coronagraphic devices which suppress the light of the star, and differential imaging techniques to pick the light from a very faint planet. This combination of techniques allows to image faint planets very close to bright stars. The achievable contrast is as low as 1 : 1 million, which means that the planet can be seen, even if it is 1 million times fainter than the parent star.

SPHERE was build by a consortium of many European institutes including the Institute of Astronomy of the ETH Zurich. The Institute of Astronomy has led the design and development of the Zurich Imaging Polarimeter (ZIMPOL), a subsystem of SPHERE, which performs imaging and polarimetry in the visual spectral range. The ZIMPOL polarimetric technique was developed at the ETH in 1990 for solar physics and it is still the most sensitive imaging polarimetry technique in Astronomy. With the financial support of the SNF and the FINES fund this technique was further developed for the SPHERE Planet Finder instrument. Polarimetry is a very powerful technique to detected scattered and therefore polarized light from a faint object near a very bright unpolarized star. If the instrument is pushed to its limits, then it might be possible to detect the reflected light from an extrasolar planet located around one of the nearest stars. ZIMPOL will also be used to map circumstellar disk in which new planets form. Extrasolar planets and the formation of planetary systems are a main focus of the ETH research group on “Star and Planet Formation” led by Prof. M. Meyer and the upcoming results from SPHERE will be very important for this research. Beside this, the SPHERE instrument is also a powerful instrument to study the immediate surroundings of all kinds of stars.



Saturn's moon Titan observed with SPHERE. Left : ZIMPOL image in the visual wavelength region (650nm), Middle : ZIMPOL polarimetric signal. Right : SPHERE near-IR image taken at a wavelength of 1.6 μm .

In May 2014 the first tests with SPHERE – ZIMPOL were carried out at the VLT telescope. Mainly functionality tests were made, but they already demonstrate the huge potential of the instrument. A good example are the observations of Saturn's moon Titan shown above. Titan appears in a normal ground-based telescope just as an unresolved point. It can only be resolved, if a ground based telescope is equipped with an adaptive optics system like SPHERE. Titan can also be resolved with the Hubble Space telescope (but the resolution of HST is 3 times lower than for VLT-SPHERE), or a space mission like Cassini which travels to Saturn.

Titan's atmosphere has a thick layer of haze which is reflecting the visual light from the sun (left) and the object appears like a featureless sphere. For the near-IR wavelengths the atmospheric haze is transparent and therefore surface structures are visible (right). The visual light reflection from the haze is highly polarized, like the blue sky for the planet Earth. Therefore we see with the ZIMPOL polarimeter a strong polarization signal along the entire limb (middle). This polarimetric technique will be used by SPHERE - ZIMPOL for a sensitive search of reflected and therefore polarized light from extra-solar planets and circumstellar disks.

Further testing with SPHERE and ZIMPOL will happen during this summer and towards the end of this year the instrument will start with the scientific observations.