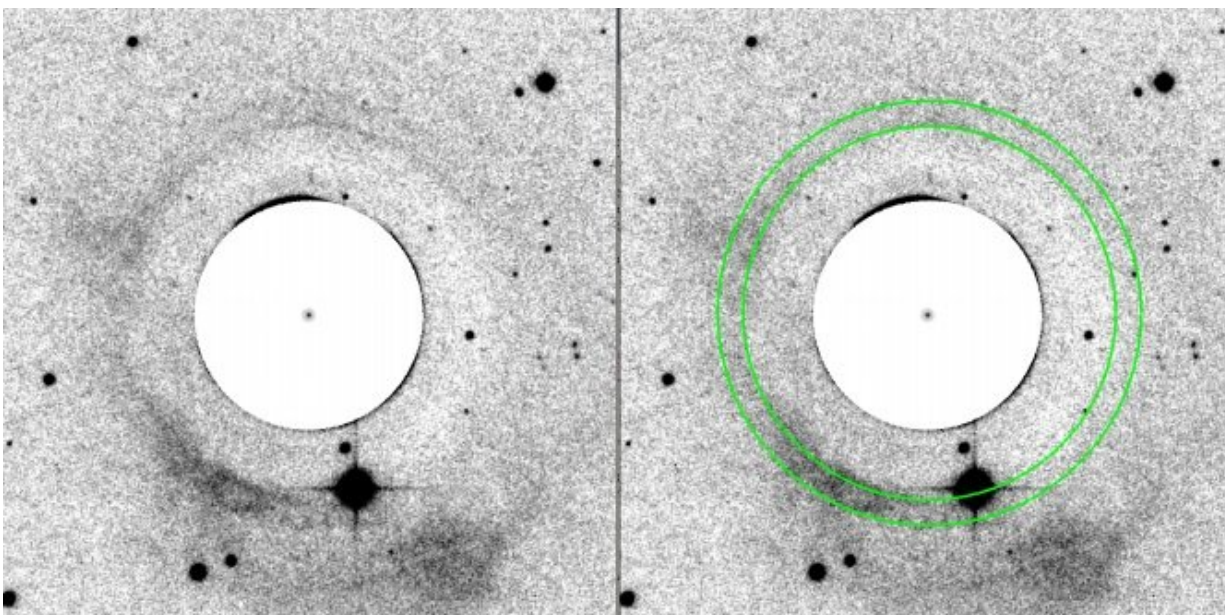


Observations unveil an ionized halo of planetary nebula IC 5148

October 15 2018, by Tomasz Nowakowski



The [O iii] image of the halo region of IC 5148: Left: after masking the main nebula and removing a Gaussian shaped decline representing the normal halo intensity distribution. Right: same image with two circles centered exactly at the CSPN at 115 and 128". Credit: Barría et al., 2018.

Using ESO's Very Large Telescope (VLT), astronomers have performed observations of the planetary nebula IC 5148. The new study, described in a paper published October 2 on the arXiv pre-print server, unveils the presence of IC 5148 ionized halo and provides fundamental parameters

of its central star.

Planetary nebulae (PNe) are expanding shells of gas and dust that have been ejected from a star during the process of its evolution from main sequence star into a red giant or white dwarf. They are relatively rare, but important for astronomers studying the chemical evolution of [stars](#) and galaxies. Although IC 5148, a round [planetary nebula](#), was discovered in 1894, it is still not well investigated in detail. The [nebula](#) is located in the constellation of Grus, some 3,000 light years away from the Earth. With an expansion rate of about 50 km/s, it is one of the fastest planetary nebulae known to date.

In order to reveal more properties of IC 5148, a team of researchers led by Daniela Barriá of the Catholic University of the North in Chile, has conducted spectroscopic observations of this nebula. For their observational campaign, the astronomers employed VLT's FORS2 and X-SHOOTER spectrographs. "We obtained long-slit low resolution spectroscopy (FORS2@VLT) of the nebula in two position angles, which we used to investigate the nebular [structure](#) and its [halo](#) in the optical range from 450 to 880 nm. In addition, we used medium resolution spectra taken with X-SHOOTER@VLT ranging from 320 nm to 2.4 μ m to derive atmospheric parameters for the central star," the researchers wrote in the paper.

Via the observations, the astronomers discovered extended emission features around IC 5148 and collected essential data about the nebula's central star. In particular, the scientists found that IC 5148 showcases a set of unusual halo structures. These structures appear clearly as hot, ionized material.

"IC 5148 shows a perfect shock structure at its outermost edge of the main nebula, as predicted in the hydrodynamic models (e.g. Perinotto et al. 2004) It is only visible by using the high ionized species as already

suggested and discussed in Guerrero et al. (2013)," the authors of the paper noted.

However, the researchers added that their discovery of structured halo emission in IC 5148 remains puzzling. They emphasized that while the inner halo region resembles the perfect circular shape as that of the main nebula, further out, a bow-like structure is seen at one side of the nebula only. Hence, the astronomers propose further deeper spectroscopic observations of this nebula to resolve the puzzle.

Moreover, the team derived essential parameters of IC 5148's [central star](#). They found that the age of this star is about 8,500 years, its average temperature is approximately 11,500 K, and its metallicity is at a level of 0.02 dex. The researchers calculated that the star's initial mass was around 1.5 solar masses.

More information: The planetary nebula IC 5148 and its ionized halo, arXiv:1810.01350 [astro-ph.SR] arxiv.org/abs/1810.01350

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