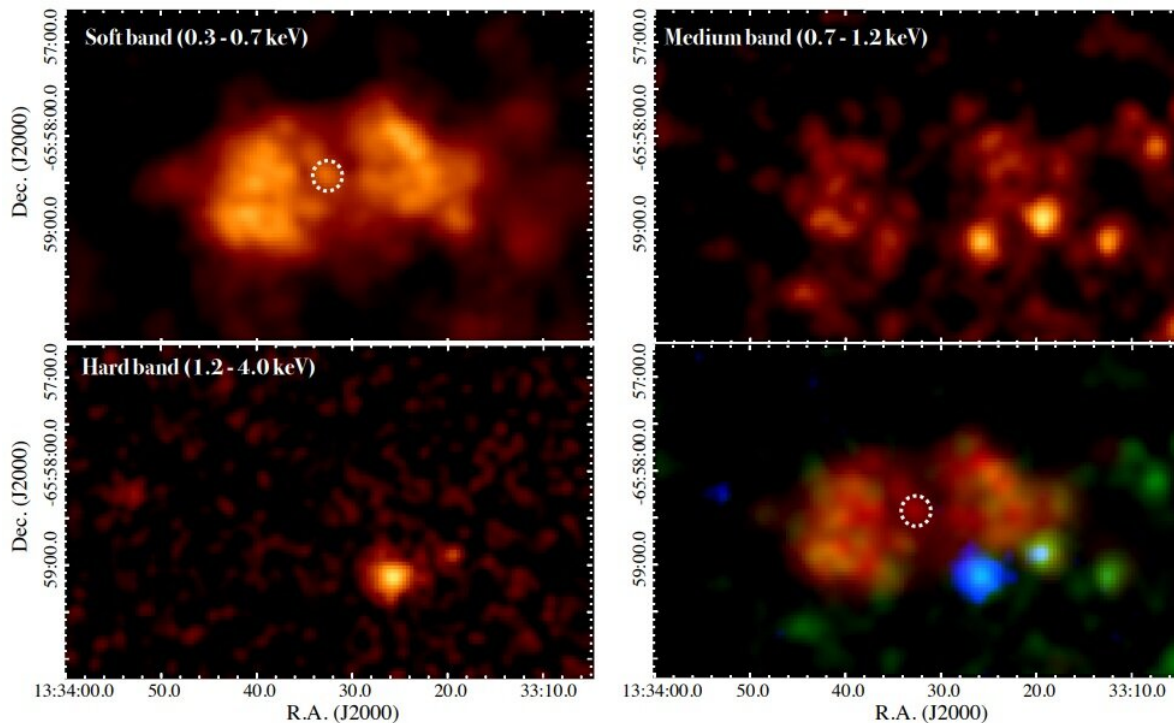


# Carbon-rich hot bubble detected in the planetary nebula NGC 5189

October 9 2019, by Tomasz Nowakowski



XMM-Newton EPIC (pn+MOS1+MOS2) images of NGC 5189. The bottom right panel shows a color-composite image combining the soft (red), medium (green), and hard (blue) bands. The position of the CSPN is shown with a circular white dashed-line aperture in the upper left and lower right panels. Credit: Toala et al., 2019.

Using ESA's XMM-Newton space telescope, astronomers have found

that the planetary nebula NGC 5189 harbors a carbon-enriched X-ray-emitting hot bubble. The discovery, presented in a paper published September 30 on arXiv.org, could shed more light on the nature of gaseous material in planetary nebulae.

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.

It is assumed that stellar winds of the central stars of planetary nebulae (CSPNe) inject energy and momentum that are transferred to the nebular envelope through X-ray-emitting hot bubbles. These bubbles, together with other physical processes, are thought to determine the expansion and evolution of PNe.

NGC 5189 (also known as PN G307.2–03.4) is a PN with an intricate morphology, hosting a Wolf–Rayet [central star](#) designated WD 1330-657. Previous observations have shown that this PN has at least three pairs of bipolar lobes expanding in different directions.

Now, a team of astronomers led by Jesus A. Toala of National Autonomous University of Mexico, reports the finding of X-ray-emitting material inside the lobes of NGC 5189. The detection was made using three European Photon Imaging Cameras (EPIC) onboard the XMM-Newton spacecraft.

"We presented the discovery of extended X-ray emission from the PN NGC 5189 around the [WR]-type star WD 1330-657," the astronomers wrote in the paper.

Images obtained with EPIC instruments disclosed the presence hot gas

within NGC 5189. It was observed that the X-ray-emitting gas is mainly distributed toward the eastern and western lobes (as seen on images) with lower surface brightness in the central region.

The study found that the extended emission in NGC 5189 is dominated by the soft X-ray band with some contribution from the medium band. However, no contribution from the hard X-ray band to the extended emission was detected.

Results of spectral analysis show that the X-ray-emitting material has a relatively high carbon abundance (about 38 times greater than that of our sun) and a plasma temperature of approximately 0.14 keV. According to the authors of the paper, these findings confirm the assumption that NGC 5189 hosts a carbon-enriched hot bubble.

The astronomers suppose that the presence of such a carbon-rich hot bubble in NGC 5189 is indicative of extreme [physical processes](#) taking place in this PN. "These PNe are thought to undergo a very late thermal pulse that further ejects carbon-rich material found in the hot bubble. This scenario is supported in NGC 5189 by the fact that the estimated abundances of the hot bubble reside between those of the PN and the CSPN," the researchers concluded.

In general, the scientists suggest that the extended X-ray emission is the result of the mixing between the carbon-rich hot bubble and the nebular material from NGC 5189. However, further observations are needed to definitively confirm this hypothesis.

**More information:** A carbon-rich hot bubble in the planetary nebula NGC 5189, arXiv:1910.00025 [astro-ph.SR] [arxiv.org/abs/1910.00025](https://arxiv.org/abs/1910.00025)

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