

Supernova remnant G53.41+0.03 investigated in detail

May 17 2021, by Tomasz Nowakowski

Astronomers have conducted detailed X-ray observations of a recently discovered supernova remnant (SNR) known as G53.41+0.03. Results of the observational campaign provide important insights into the properties of this object. The study was detailed in a paper published May 7 on the arXiv pre-print server.

SNRs are diffuse, expanding structures resulting from a [supernova](#) explosion. They contain ejected material expanding from the explosion and other interstellar material that has been swept up by the passage of the shockwave from the exploded star.

Studies of [supernova remnants](#) are important for astronomers, as they play a key role in the evolution of galaxies, dispersing the [heavy elements](#) made in the supernova explosion and providing the energy needed for heating up the interstellar medium (ISM). SNRs are also believed to be responsible for the acceleration of galactic cosmic rays.

G53.41+0.03 was confirmed as a supernova remnant in 2018 by analyzing the data from the LOFAR (LOW Frequency ARray) Two-meter Sky Survey. The SNR has a relatively young age and is estimated to be located some 24,450 [light years](#) away.

Given that the nature of G53.41+0.03 is still poorly understood, a group of astronomers led by Vladimír Domček of the University of Amsterdam, the Netherlands, decided to take a closer look at this SNR. Using ESA's XMM-Newton spacecraft, they performed X-ray

observations of this object with the main aim of investigating its morphological structure.

"In this work, we follow up SNR G53.41+0.03 with a new dedicated 70ks XMM-Newton observation," the astronomers wrote in the paper.

The observations found that G53.41+0.03 has a half-shell morphology of 3.5' in size with most of the emission coming from the upper half (in galactic coordinates). The lower half of the SNR does not show any clear morphological detection. The size of the remnant in X-rays turned out to be smaller than in the radio band, which is most likely caused by a high image resolution provided by XMM-Newton.

The study identified three unique regions of the remnant, all well characterized by the non-equilibrium ionization plasma model. These regions showcase differences in their brightness and plasma characteristics. The astronomers assume that this is likely caused by the higher density in the brightest region and a combination of lower density and the proximity to the galactic plane in the faintest region.

Furthermore, the [spectral analysis](#) revealed that G53.41+0.03 is between 1,000 and 5,000 years old, which confirms the relatively young age of this SNR. The observations also found two interesting point sources in the geometrical center of G53.41+0.03. One of these sources is a young stellar object (YSO), while the second one appears to be a magnetar, however further investigation of this source are needed in order to disclose its nature.

More information: Completing the X-ray view of the recently discovered supernova remnant G53.41+0.03, arXiv:2105.02661 [astro-ph.HE] arxiv.org/abs/2105.02661

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