Researchers study kinematics of the supernova remnant G109.1-1.0

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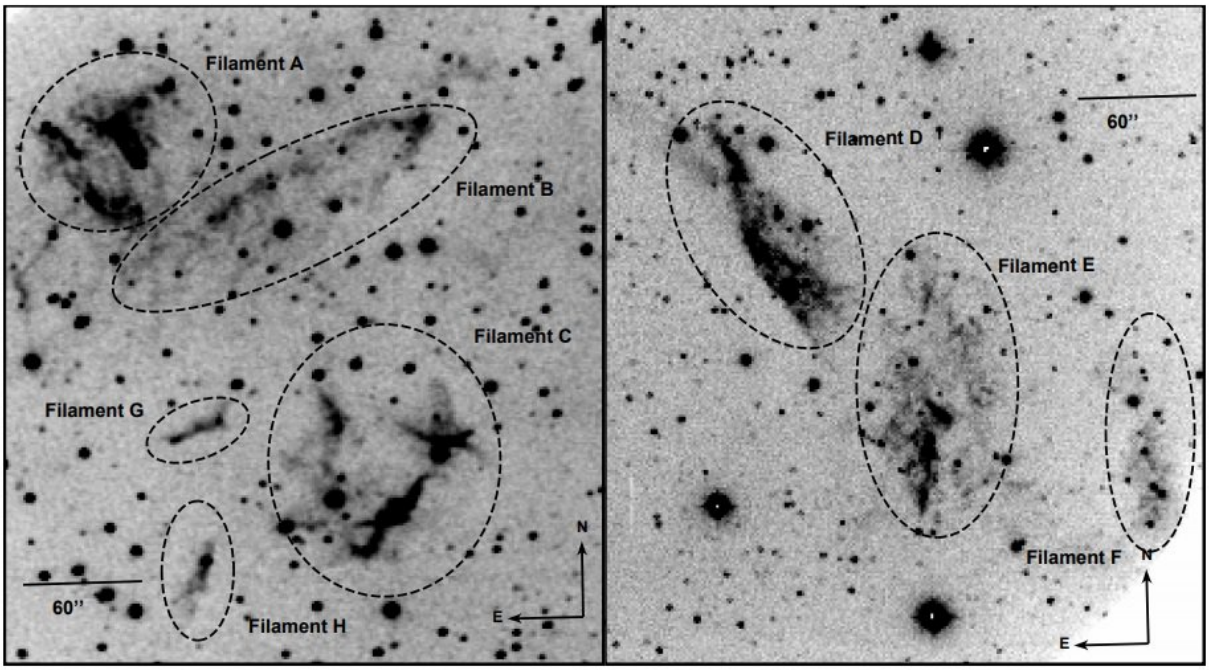

[SII]λλ6717,6731 Å direct images of the different filaments of the SNR CTB 109 taken with PUMA in its direct image mode. Left panel corresponds to the northeastern filaments, while right panel corresponds to southeastern filaments. Credit: Sánchez-Cruces et al., 2017.

(Phys.org)—A team of astronomers from Mexico has lately conducted a kinematics study of a supernova remnant in the Milky Way galaxy

known as G109.1-1.0 (or CTB 109). The new research reveals crucial insights into basic properties of this remnant. The findings were presented Sept. 23 in a paper published on the arXiv preprint repository.

Supernova remnants (SNRs) are diffuse, expanding structures resulting from a supernova explosion. SNRs contain ejected material expanding from the explosion and other interstellar material that has been swept up by the passage of the shock wave 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 into the interstellar medium (ISM) and providing the energy needed for heating up the ISM. SNRs are also believed to be responsible for the acceleration of galactic cosmic rays.

G109.1-1.0 is one such remnant located in the Milky Way's Perseus arm. Previous observations of this SNR revealed that it has a semicircular shell-type morphology. However, the astronomers have not yet definitely determined basic properties of this remnant, such as its distance, age and the amount of energy deposited in the interstellar medium in result of the explosion. Various studies produced significant discrepancies in the results.

Recently, a team of researchers led by Mónica Sánchez-Cruces of the National Polytechnic Institute in Mexico City has studied the kinematics of G109.1-1.0, which allowed them to diminish the uncertainties presented in previous papers. Their research is based on observations carried out in June 2015 with the use of a scanning Fabry-Perot interferometer known as PUMA. The instrument is installed on the 2.1 m telescope at the National Astronomical Observatory in Sierra de San Pedro Mártir, Mexico.

"We obtained a set of direct images in Hα and [SII]λλ6717,6731 Å using the PUMA focal reducer without the Fabry-Perot interferometer in the instrument optical axis. The exposure time of each of the direct images was 120 s. We also obtained [SII]λλ6717,6731 Å Fabry-Perot data cubes of two regions of the SNR CTB 109," the paper reads.

By analyzing the new images, the astronomers found that the distance to G109.1-1.0 is about 10,100 light years, which is consistent with one study published in 2012. When it comes to the age of this remnant, the researchers calculated it to be between 9,000 and 9,200 years.

Furthermore, the authors estimated the initial energy deposited in the interstellar medium by the supernova explosion. According to the research, this value lies between 180 and 520 quindecillion erg.

The scientists concluded that the remnant's relatively young age and the amount of energy deposited in the ISM, indicate that G109.1-1.0 contains simple pulsars. "The age is of thousands of years and the (E0) is rather typical of SNRs containing simple pulsars," the authors wrote in the paper.

Besides determining these basic parameters, the team also found that the remnant's systemic velocity is approximately –50 km/s, while its expansion velocity equals some 230 km/s.

More information: Kinematics of the Galactic SNR G109.1-1.0 (CTB 109) arXiv:1709.07986 [astro-ph.GA] arxiv.org/abs/1709.07986

https://phys.org/news/2017-10-kinematics-supernova-remnant-g1091-.html