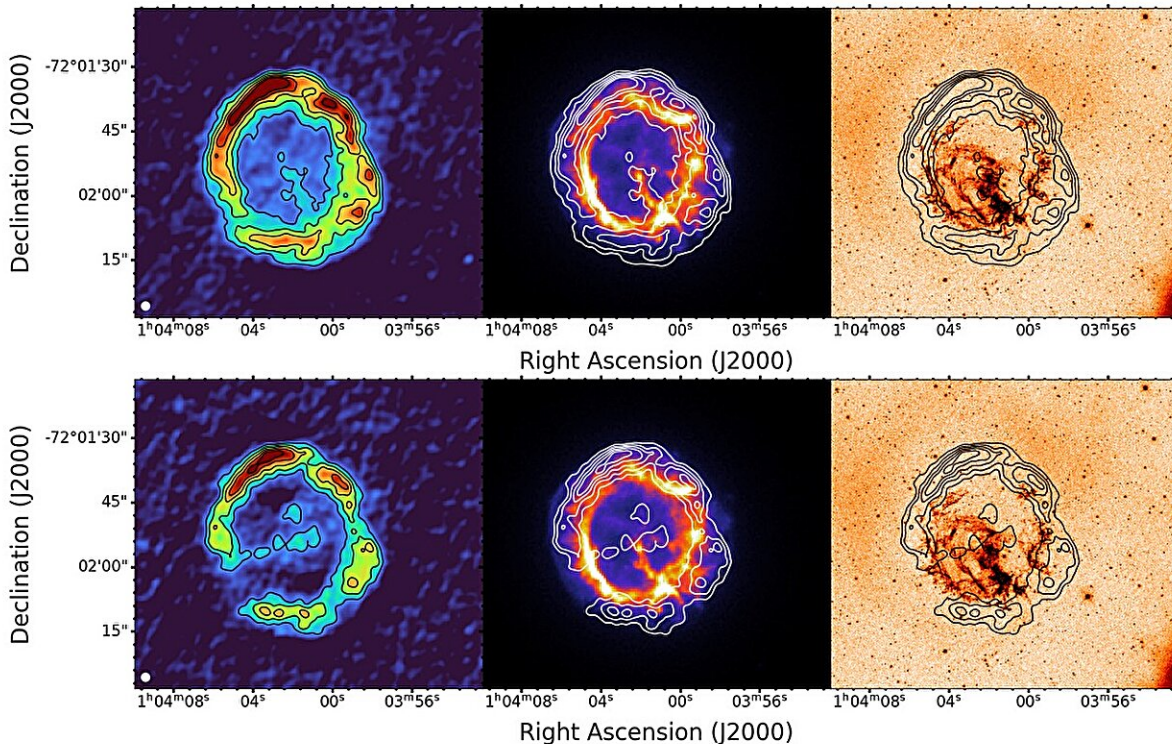


Research explores the properties of supernova remnant 1E 0102.2–7219

November 3 2023, by Tomasz Nowakowski



Images of E0102 with 5,500 MHz contours overlaid (top) and 9,000 MHz contours overlaid (bottom). Credit: *Monthly Notices of the Royal Astronomical Society* (2023). DOI: 10.1093/mnras/stad3300

Using the Australia Telescope Compact Array (ATCA) and the Atacama Large Millimeter/submillimeter Array (ALMA), an international team of

astronomers has observed a supernova remnant known as 1E 0102.2–7219. Results of the study, presented October 27 in the *Monthly Notices of the Royal Astronomical Society* journal, shed more light on the properties and nature of this remnant.

In general, supernova remnants (SNRs) are diffuse, expanding structures resulting from a supernova explosion. Observations show that SNRs 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.

Discovered in 1981, 1E 0102.2–7219 (or E0102 for short) is a young core-collapse SNR in the Small Magellanic Cloud (SMC)—a dwarf galaxy orbiting the Milky Way. It showcases a bright, filled ring-like structure with an outer edge that traces the forward-moving blast wave. Previous [observations](#) have found that E0102 has an age of 1,738 years and its progenitor mass is estimated to be most likely between 32 and 50 solar masses.

Now, a group of astronomers led by Rami Z. E. Alsaberi of the Western Sydney University in Penrith, Australia, decided to investigate E0102 with ATCA and ALMA in order to get more insights into its properties.

"Here, we present new high-resolution and high-sensitivity radio-continuum observations of E0102 obtained from ATCA and ALMA," the researchers wrote in the paper.

The observations found that E0102 shows a ring morphology with a mean radius of about 20.2 [light years](#) and a bridge-like structure. The images also unveiled the presence of a horizontal bridge or bar-like feature in the central region of E0102 with a measured flux density of 4.3 mJy.

The mean spectral index across the entire remnant was found to be -0.54 . It turned out that most areas near the circumference have a steep spectral index (of approximately -0.6) at both inner and outer radii, while indices with flat gradients are found at intermediate radii. The [radio emission](#) appears to be brightest in the north-east part of E0102.

The observations revealed that E0102 shows polarized regions in its shell and the mean fractional polarization for this remnant was measured to be 7 and 12% for 5,500 and 9,000 MHz, respectively. The data also allowed the astronomers to calculate the line-of-sight [magnetic field strength](#) in the direction of E0102, which turned out to be at a level of 44 μG with an equipartition field of $65 \pm 5 \mu\text{G}$.

When it comes to the environment of E0102, the observations show an cloud of neutral atomic hydrogen (HI) towards this remnant at the velocity range of about 160–180 km/s and a cavity-like structure at the velocity of 163.7–167.6 km/s.

Summing up the results, the authors of the paper concluded that the properties of E0102 are consistent with that of a typical young SNR. They added that a relatively low integrated linear polarization of this remnant indicates a high degree of turbulence.

More information: Rami Z E Alsaberi et al, ATCA Study of Small Magellanic Cloud Supernova Remnant 1E 0102.2–7219, *Monthly Notices of the Royal Astronomical Society* (2023). [DOI: 10.1093/mnras/stad3300](https://doi.org/10.1093/mnras/stad3300)

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