Typing supernova remnant G352.7−0.1 using XMM-Newton X-ray observations

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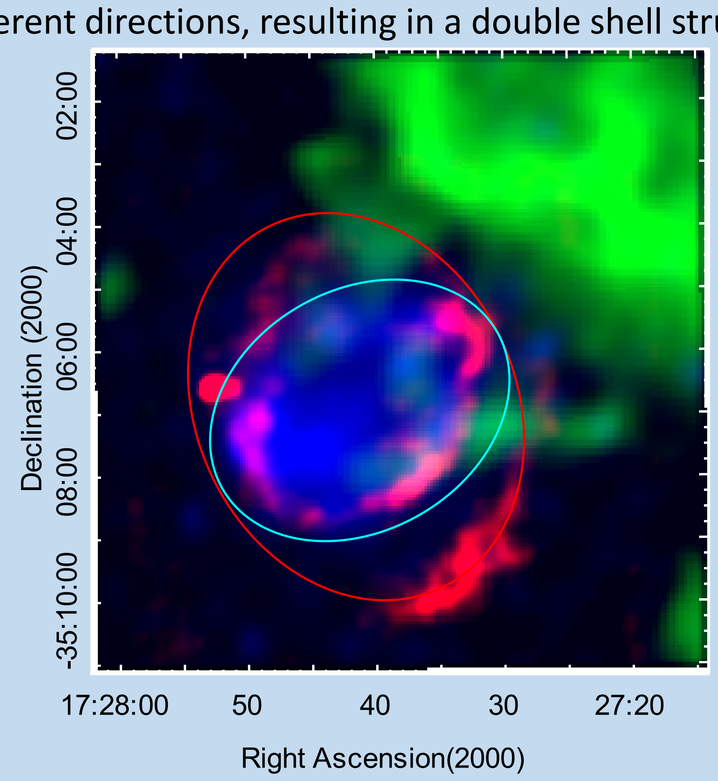
Background

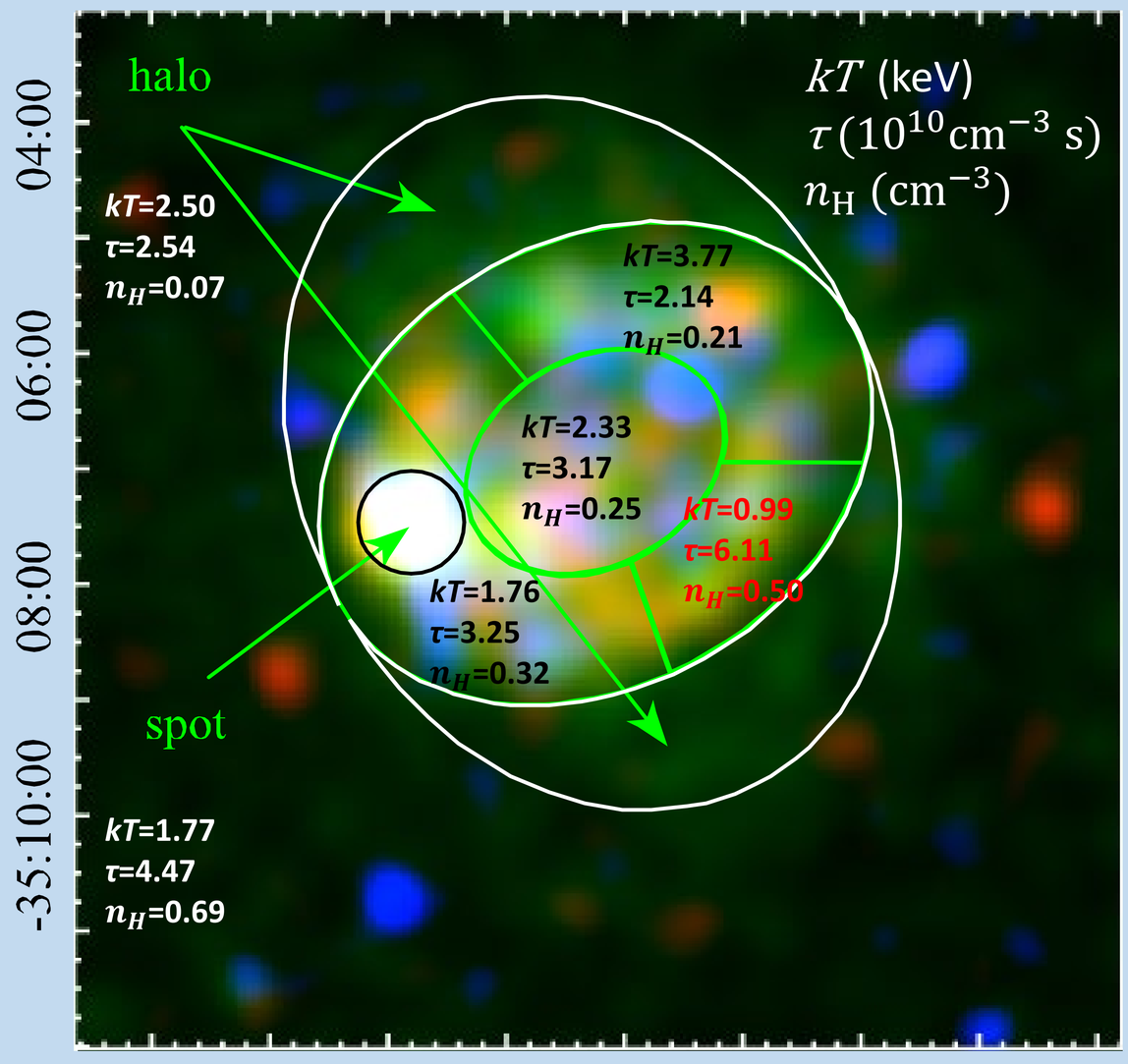
G352.7-0.1 is a mixed-morphology supernova remnant with a center-filled X-ray morphology and a double shell-like radio morphology. Previous studies suggest a Type-Ia origin of the remnant due to the low-ionization state of the Fe K-shell line. We performed an XMM-Newton X-ray study of the remnant, aiming to understand the explosion mechanism and the origin of its mixed-morphology.

Interaction with the molecular clouds and spatial distribution of plasma parameters

The difference in the density of the interstellar medium between the halo and inner regions causes the shock wave to expand at different speeds in different directions, resulting in a double shell structure.



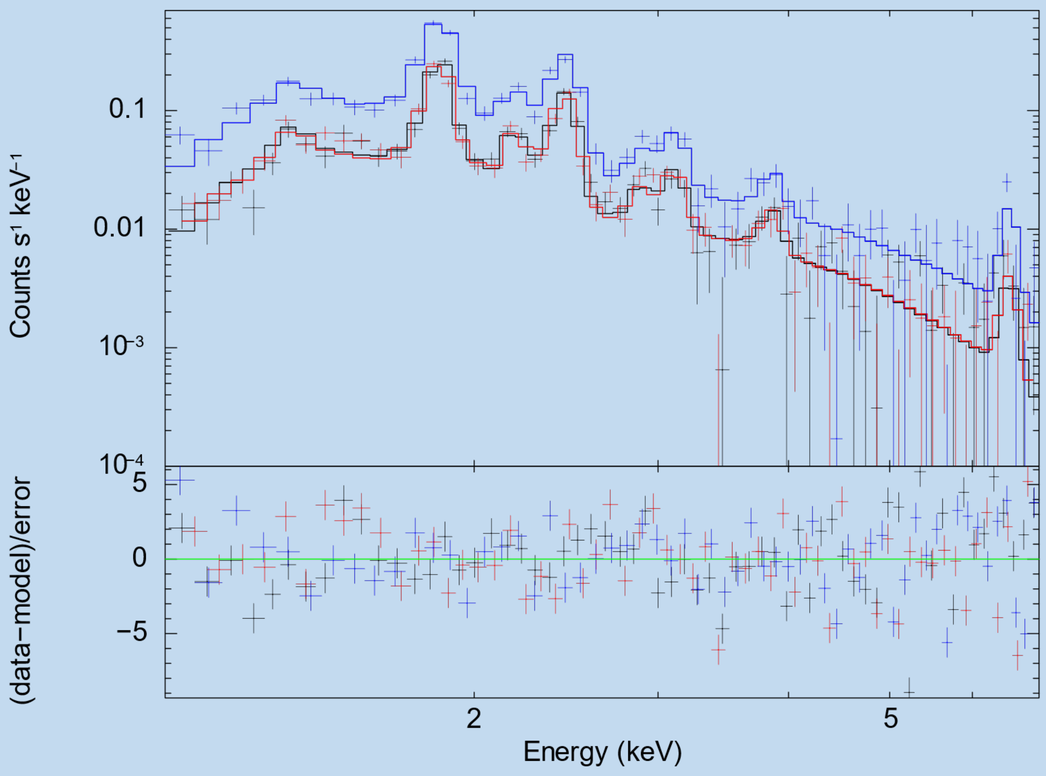
SNR G352.7-0.1 interacts with molecular clouds. Red: VLA 4.8 GHz radio continuum image (Giacani E. et al. 2009); Green: APEX ^{12}CO molecular cloud image (Zhang et al. ApJ in press); Blue: XMM-Newton 0.8-7 keV X-ray image.



There is a significant difference in density between the halo and the bright X-ray regions of supernova remnant. The low-temperature, high-density regions confirm the interaction with a dense medium. X-ray image of G352.7−0.1 (Red: 0.8-1.5 keV; Green: 1.5-3.3 keV; Blue: 3.3-7 keV).

Plasma and evolution parameters

By fitting the spectrum, we obtained parameters such as **temperature** (kT=2.06 keV) and calculated the **average hydrogen density** of the SNR (0.16 $\rm cm^{-3}$), the **ionization age** (5.0 kyr), the **Sedov age** (2.9 kyr), and the **supernova explosion energy** (1.37×10^{50} erg ;the explosion energy has a large systematic error).

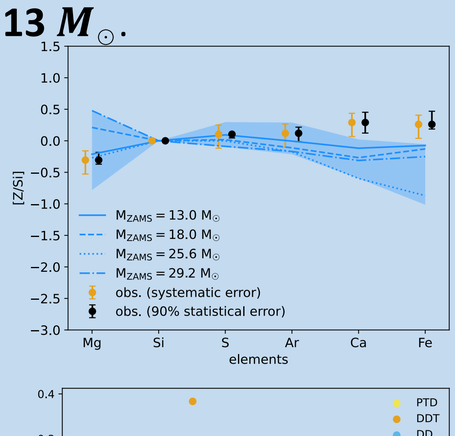


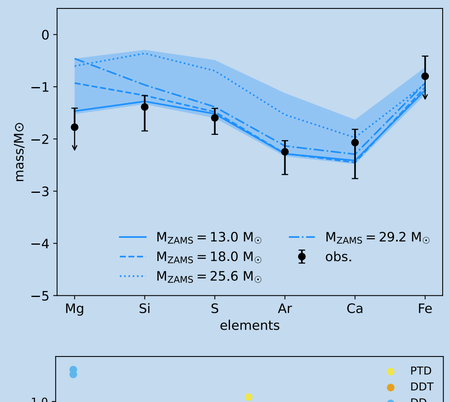
XMM-Newton MOS1, MOS2, and pn spectra in 0.8–7 keV (black, red, and blue, respectively).

Explosion mechanism and progenitor mass inferred by metals

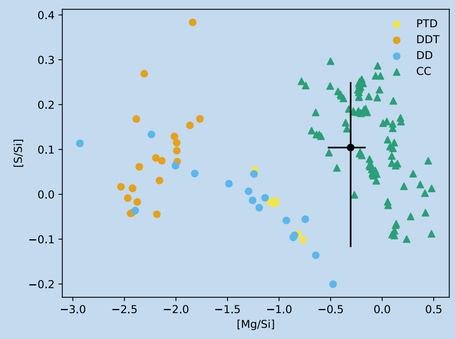
By comparing with supernova nucleosynthesis models, we suggest that believe that G352.7-0.1 originated from a **core-collapse supernova** with a progenitor mass of **13 $M_\odot$**.

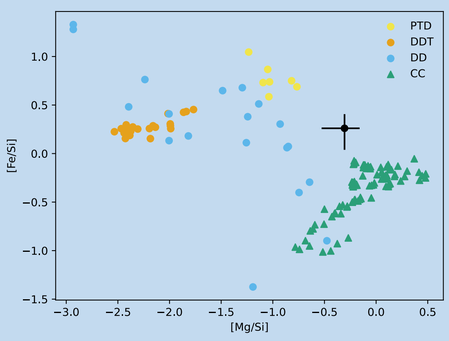
Core-collapse





[Mg/Si]–[S/Si] diagram and [Mg/Si]-[Fe/Si] diagram





Reference

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