X-rays from Superbubble Candidates in M31

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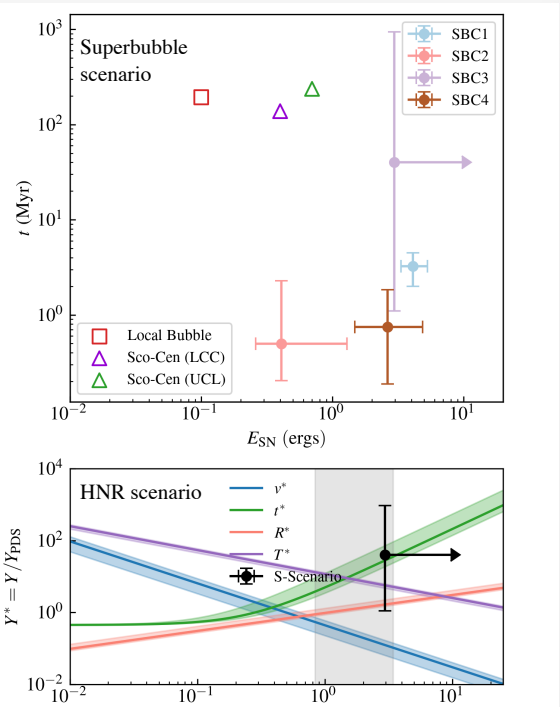
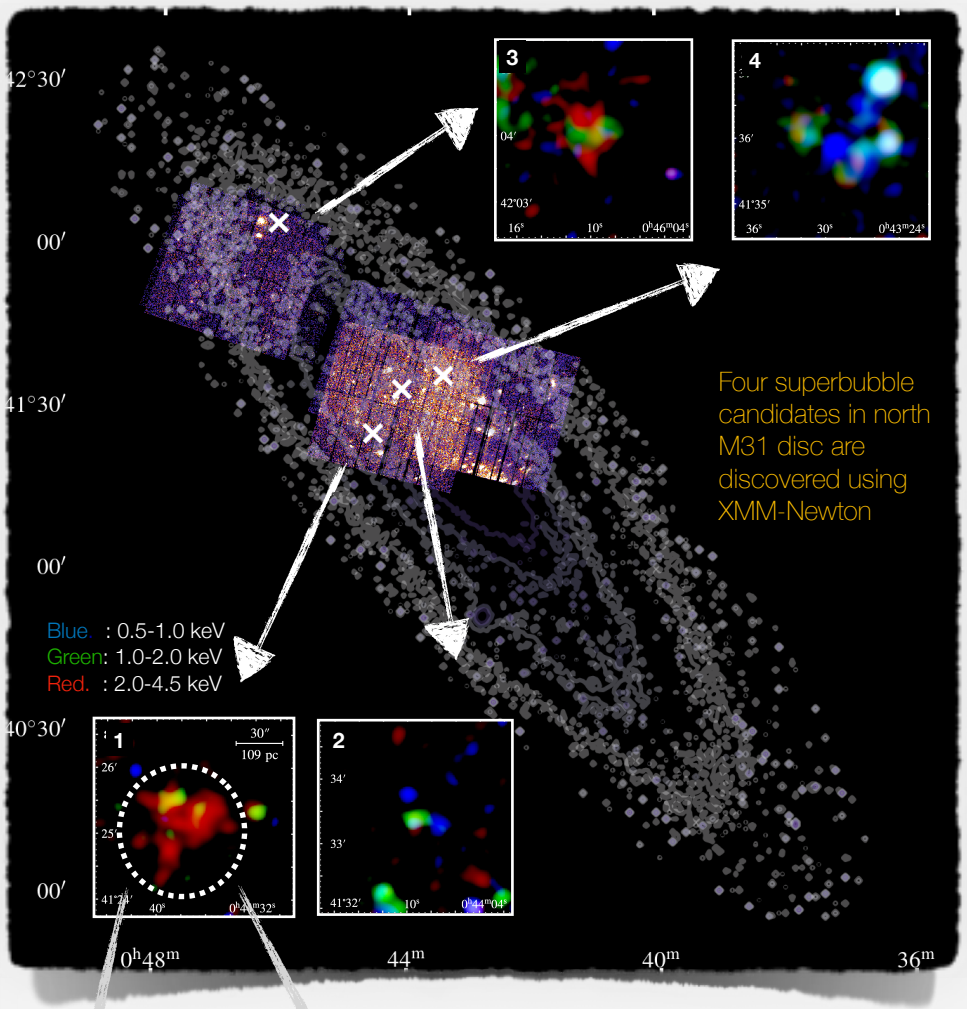
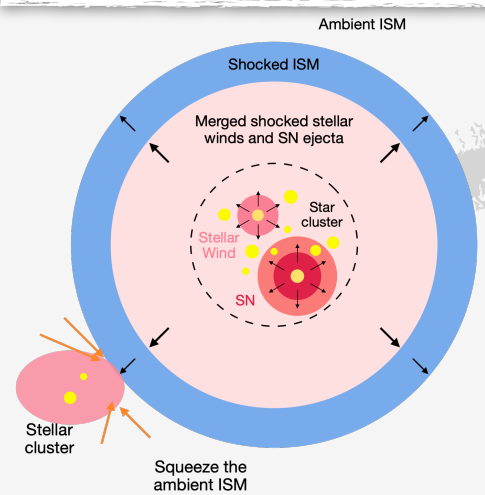
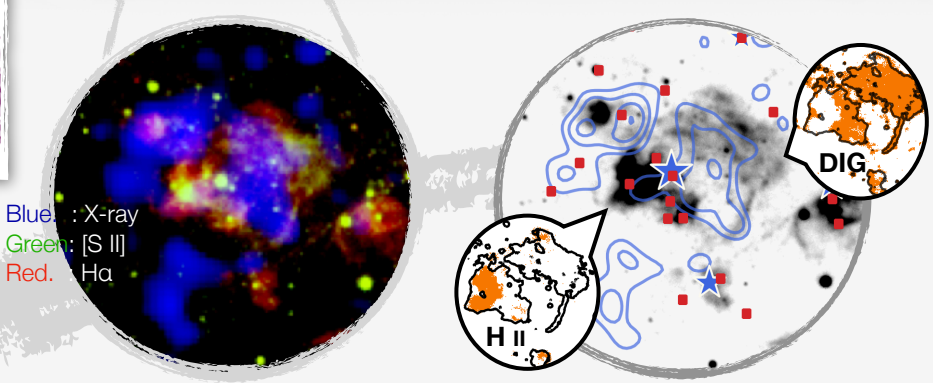
A superbubble is a hot, dilute, and X-ray-emitting gas cavity produced by stellar winds or supernova explosions, or both. It is a rarely observed but intriguing feature for the study of stellar feedback processes, and can be the tracers of the past star formation activity. We perform an XMM-Newton study of four superbubble candidates (SBC, labeled as 1-4) in the northern disc of M31. The origin of X-ray emission are discussed both under a superbubble and a hypernova remnant (HNR) scenario. Shell-like structures spatially coincide with SBC1 are observed in Hα images. They could have swept up and compressed the ambient gas to create a dense shell, consequently triggering the star formation in this region.





- **SBC1-4 show diffused, soft X-ray emission structures on XMM-Newton images. From spectra fitting results, the average temperature is low, less than 1 keV for all the candidates.**
- **The dynamical ages of the four superbubble range from a few tenths to several Myr, younger than superbubbles observed in the Milky Way, which suggests a selection effect. For SBC1, SBC2, and SBC4, the superbubble scenario is more consistent with observations, while SBC3 favors the hypernova remnant scenario.**
- **An active star formation could have taken place at the edges around SBC1. The expanding superbubble swept away the ambient gas, triggering star formation at the superposition of the in situ high-n_e region and the bubble interface.**





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