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DIFFUSE X-RAY EMISSION FROM THE SUPERBUBBLE N70

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We present a study of the diffuse X-ray emission from the superbubbles N70. Using observations from the XMM-Newton satellite we obtained images and spectra over the energy range 0.2 to 10 keV of this superbubble.

Massive stars transfer energy to the interstellar medium (ISM) in two ways during their lifetime: by radiative luminosity and by mechanical luminosity. The mechanical luminosity of the stellar wind is less than 1 per cent of the stellar radiative luminosity. However, the mechanical luminosity is much more efficient for transferring energy to the ISM. The classical example is presented in OB associations, which are composed by early-type massive stars that have strong stellar winds. They sweep up the surrounding ISM creating a superbubble around associations of OB stars. The standard model (Weaver et al. 1977) describes this superbubble as a structure that consists of a shell of swept-up ISM, cool and bright in optical emission lines, that contains shock-heated gas that emits soft X-rays at its interior.

The superbubble N70 (DEM L301) is an almost circular shell of approximately 100 pc in diameter. It contains in its interior the young OB association LH 114, with more than 1000 stellar sources (The SIMBAD Astronomical Database); of these, seven are O-type stars. The mean age of this OB association is approximately 5 Myr, which is sufficient time for the first supernova explosion to occur.

In this work we have presented XMM-Newton images at soft and hard diffuse X-ray emission, as well as spectra of N70. We found, that the spectra present two components: a thermal one –associated with the soft X-rays emission– and a non-thermal one – associated with the hard X-ray emission. The morphologies of the thermal (soft) and non-thermal (hard) components are also different. The soft X-rays come from the internal regions of the superbubbles, whereas the emission of the hard X-rays comes from the external shell of the superbubbles, see Figure 1.

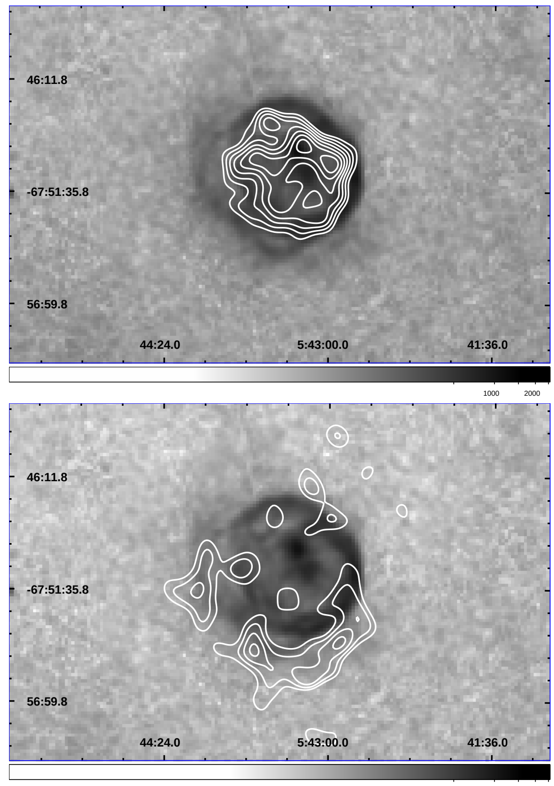

Fig. 1. MCELS image in Hα (blue) of the superbubble N70 in the LMC. Top: superposed onto this picture are the X-ray contours in the 0.2–2.0 keV energy band. Bottom: superposed onto this picture are the X-ray contours in the 2.0–10.0 keV energy band.

A possible scenario is that the soft X-ray emission comes from shocked gas, heated to high temperatures ($\sim 10^6$ K) by the interaction between the sourronding medium and the winds of massive stars in the interior, or even of SN explosions of even more massive stars that have already evolved and exploted. The hard X-ray emission would come from particle acceleration by shocks –in the shell– (Bamba et al. 2004).

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