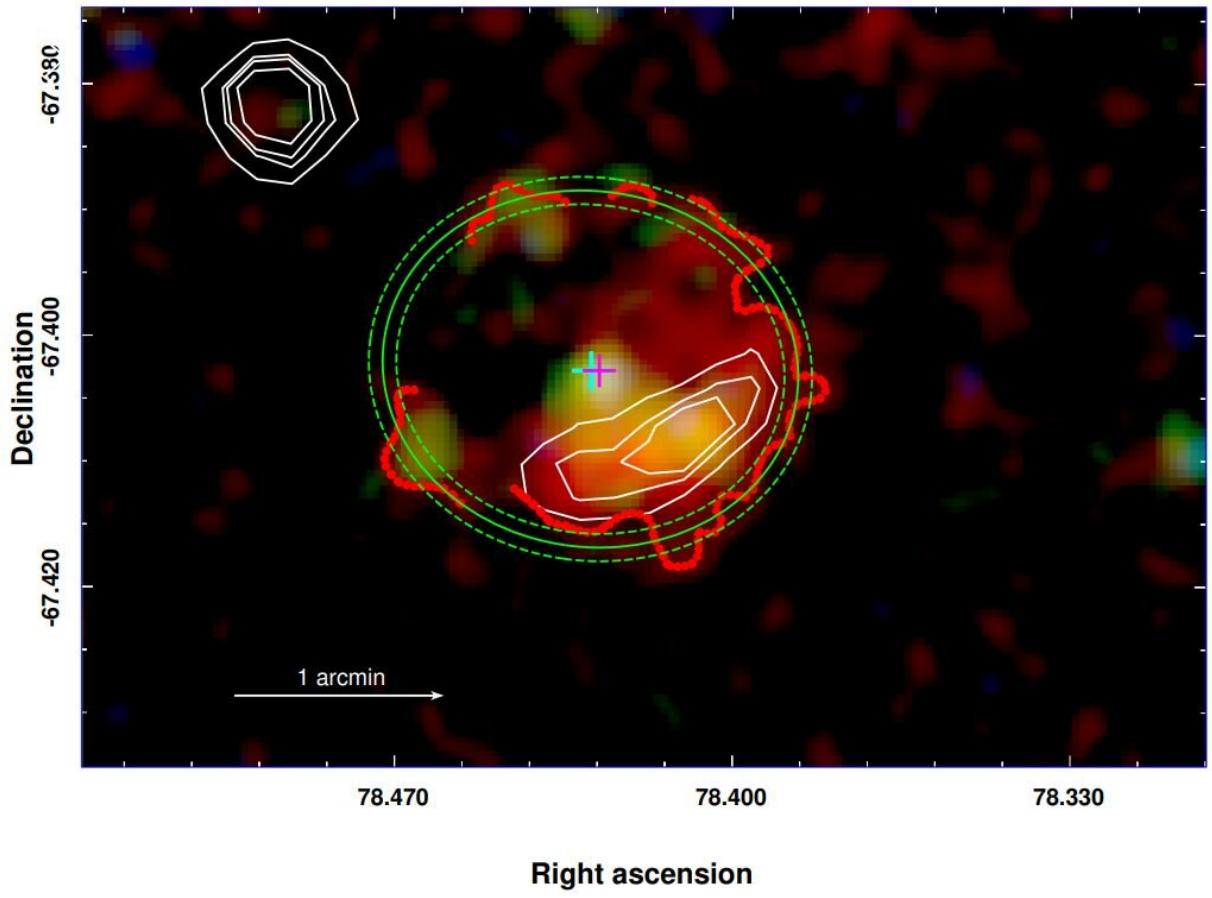
New high-mass X-ray binary detected in the Large Magellanic Cloud

October 16 2019, by Tomasz Nowakowski



XMM-Newton EPIC RGB image of MCSNR J0513-6724. Credit: Maitra et al., 2019.

Using ESA's XMM-Newton spacecraft, an international team of

astronomers has discovered a new, very young high-mass X-ray binary (HMXB) in the Large Magellanic Cloud (LMC). The newly found HMXB turns out to be associated with the supernova remnant (SNR) MCSNR J0513-6724. The finding is reported in a paper published October 7 on arXiv.org.

X-ray binaries are composed of a normal star or a white dwarf transferring mass onto a compact neutron star or a black hole. Based on the mass of the companion star, astronomers divide them into low-mass X-ray binaries (LMXBs) and high-mass X-ray binaries (HMXBs).

HMXBs associated with SNRs, especially those systems containing a neutron star, are a rare find. However, Magellanic Clouds, due to their proximity, their excellent environment for hosting young stellar remnants, and high formation efficiency for X-ray binaries, are a promising place to search for new HMXBs in SNRs.

A group of astronomers led by Chandreyee Maitra of Max Planck Institute for Extraterrestrial Physics in Germany, took a closer look at LMC. By analyzing data from XMM-Newton, they found that one of LMC's supernova remnants harbors an HMXB.

"We report the discovery of a very young high-mass X-ray binary system associated with the supernova remnant MCSNR J0513-6724 in the Large Magellanic Cloud, using XMM-Newton X-ray observations," the astronomers wrote in the paper.

First of all, the study confirmed that MCSNR J0513-6724 is, indeed, a supernova remnant. The researchers found that an HMXB resides at the geometrical center of this SNR. In particular, this new binary was first identified as a faint X-ray point source, most prominent in the hard X-rays above 1.0 keV, at the center of MCSNR J0513-6724.

According to the paper, the newly discovered HMXB is composed of a neutron star with a spin period of around 4.4 seconds and most likely a massive early-type star (probably supergiant) of spectral type B2.5Ib. However, the exact nature of the companion star still needs further verification by high-resolution optical spectroscopic observations.

Moreover, the astronomers estimated that the age of MCSNR J0513-6724 is less than 6,000 years. This means that the newfound binary seems to be one of the youngest HMXBs known to date. So far, with an estimated age below 4,600 years, Circinus X-1 is most likely the youngest known X-ray binary inside an SNR, but it still needs to be confirmed whether it's an HMXB or a LMXB.

The research found that the orbital period of the system is approximately 2.23 days and its luminosity is about 7.0 decillion erg/s. The astronomers also calculated an upper limit to the magnetic field strength of this HMXB. This value is most likely not greater than 500 billion G.

In concluding remarks, the scientists underlined how much important could be their discovery for improving our understanding of evolution of magnetic field in X-ray binary systems.

"The discovery of a very young HMXB of age