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NuSTAR results on Ultra-Luminous X-ray sources: black holes or neutron stars?

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Ultraluminous X-ray sources (ULXs) are extremely bright, off-nuclear point sources in nearby galaxies. The only process known to power them is a very high accretion rate onto a compact object. If the compact object is similar to those observed in our own galaxy, i.e., a standard stellar remnant, the accretion rate has to exceed the Eddington rate by a factor of 10-100 in a so-called super-Eddington accretion regime. If on the other hand the compact were more massive, ULXs would be the only known evidence for intermediate mass black holes with masses of 100's or 1000's solar masses. Broadband spectral studies of a sample of ULXs, making full use of the hard X-ray sensitivity of the Nuclear Spectroscopic Telescope Array (NuSTAR), are suggestive of super-Eddington accretion. A definitive answer has, however, not yet been reached owing to continued difficulty constraining ULX masses. I will report on recent, multi-epoch NuSTAR observations, which allow us to examine the evolution of these enigmatic sources and their accretion process by studying their time variability and hard X-ray spectrum above 10keV. In a surprising discovery we have recently shown that the ULX M82 X-2 harbors a neutron star, the first evidence for a neutron star in a ULX. I will discuss possible modes of super-Eddington accretion on neutron stars and compare M82 X-2 to known accreting neutron stars in our galaxy.

[1]On behalf of the NuSTAR ULX science team led by Fiona Harrison