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X-ray Binary Luminosity Function Scaling Relations for Local Galaxies Based on Subgalactic Modeling

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With the detection of compact-object mergers with LIGO/VIRGO there is a resurgence in modeling efforts to understand the evolution of interacting close binaries, including X-ray binaries (XRBs). Critical high-value empirical constraints on this effort can be gained by XRB X-ray luminosity functions (XLFs), which provide many degrees of freedom for testing models. Using a sample of 38 nearby galaxies (D < 30 Mpc) that have Chandra observations (5.8 Ms total), and a wealth of FUV-to-FIR data, we characterized on subgalactic scales how the XRB XLF varies with specific-SFR (sSFR=SFR/M). We find that the XLF clearly transitions from LMXB-dominant to HMXB-dominant going from low-to-high sSFR environments, and we characterize in detail the HMXB and LMXB XLF shapes and scaling relations with SFR and M, respectively. With this rich data set, we show that the HMXB and LMXB XLFs exhibit more complex shapes and variations with sSFR than previously reported, and we find evidence for metallicity and stellar age dependences in the XLF shapes and scalings. We put into context these findings with recent studies of XRB evolution reported from the Chandra Deep Fields and COSMOS surveys, and discuss ways forward for linking studies of XRBs to other astrophysical systems (e.g., GW sources).

Topic

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