X-RAY ASTRONOMY 2019
Current Challenges and New Frontiers in the Next Decade
8-13 September 2019
CNR/INAF Research Area, Bologna, Italy

Contribution ID: **156** Type: **Contributed**

Astrometry of Black Hole X-ray Binaries with Gaia DR2: Implications for their formation and evolution

Monday, 9 September 2019 12:45 (15 minutes)

Fundamental properties of black hole X-ray binaries (BHXBs) are important in massive stellar evolution and high energy astrophysics. But, their astrometric properties have been reported for a handful of objects, because their transient behavior, faint optical counterparts and large distances (> 1 kpc) have made comprehensive astrometric investigations of BHXBs very challenging. Gaia has dramatically changed this situation. We present distance and peculiar motion results for 11 BHXBs using Gaia DR2, with peculiar velocities for 7 of them being reported for the first time. Distances estimated using Bayesian methods are found to be in agreement with those reported in the literature which all used photometric and spectroscopic methods, with the only exception being BW Cir. We further emphasize Gaia's potential in measuring distances of newly discovered transients with two recent examples: MAXI J1820+070 and MAXI J1727-203. Our results on the observed weak anti-correlation between the kinetic energy of peculiar motion and BH mass suggests a BH formation scenario where the natal kick imparted to the black hole during core collapse scales with its mass. We will discuss the formation of BHXBs, particularly focusing on short orbital period systems, based on our investigation of their z-heights from the Galactic plane and their orbital period distribution. We further utilized Gaia data of Cyg X-1 and neighboring stars in the region of Cyg OB3. The consistent values of distance, proper motion, peculiar and relative velocity of Cyg X-1 and those of the other stars in the region suggests that Cyg OB3 can be identified as the parent stellar association of Cyg X-1. With the present and forthcoming data releases, Gaia has emerged as a powerful aide in probing the properties of BHXBs.

Topic

Multi-messenger and transient astronomy

Affiliation

University of Southampton

Primary authors: Dr RAO, Anjali (University of Southampton); Dr GANDHI, Poshak (University of Southampton); Mr PAICE, John A (University of Southampton); Dr KNIGGE, Christian (University of Southampton); Prof. CHARLES, Phil A (University of Southampton); Mr JOHNSON, Michael A.C. (University of Southampton); Prof. MACCARONE, Thomas J. (Texas Tech University)

Presenter: Dr RAO, Anjali (University of Southampton)

Session Classification: MULTI-MESSENGER AND TRANSIENT ASTRONOMY