Contribution ID: **12** Type: **Talk**

Do Intermediate-Mass Black Holes Exist in Galactic Globular Clusters? - Clues From X-ray Observations and Hydrodynamical Simulations

Friday, 23 August 2024 09:20 (20 minutes)

Globular clusters (GCs) are thought to harbor the long-sought population of intermediate-mass black holes (IMBHs). We present a systematic search for a putative IMBH in 81 Milky Way GCs, based on archival {\it Chandra} X-ray observations. We find in only six GCs a significant X-ray source positionally coincident with the cluster center, which have 0.5–8 keV luminosities between $\sim 1 \times 10^{30}$ erg s^{-1} to $\sim 4 \times 10^{33}$ erg s^{-1}. However, the spectral and temporal properties of these six sources can also be explained in terms of binary stars. The remaining 75 GCs do not have a detectable central source, most with 3σ upper limits ranging between 10^{29-32} erg s^{-1} over 0.5–8 keV, which are significantly lower than predicted for canonical Bondi accretion. To help understand the feeble X-ray signature, we perform hydrodynamic simulations of stellar wind accretion onto a $1000\,M_\odot$ IMBH from the most-bound orbiting star, for stellar wind properties consistent with either a main-sequence (MS) star or an asymptotic giant branch (AGB) star. We find that the synthetic X-ray luminosity for the MS case ($\sim 10^{19}$ erg s^{-1}) is far below the current X-ray limits. The predicted X-ray luminosity for the AGB case ($\sim 10^{34}$ erg s^{-1}), on the other hand, is compatible with the detected central X-ray sources, in particular the ones in Terzan 5 and NGC 6652. However, the probability of having an AGB star as the most-bound star around the putative IMBH is very low. Our study strongly suggests that it is very challenging to detect the accretion-induced X-ray emission from IMBHs, even if they were prevalent in present-day GCs.

Affliation

Nanjing Univeristy

Current Position

PhD Student

Primary author: SU, Zhao (Nanjing University)

Co-authors: HOU, Meicun (Peking University); ZHANG, Mengfei (Zhejiang University); LI, Zhiyuan (Nanjing University); CHENG, Zhongqun (Wuhan University)

Presenter: SU, Zhao (Nanjing University)

Session Classification: Chris Belczynski memorial session on compact objects and gravitational wave sources

Track Classification: Chris Belczynski memorial session on compact objects and gravitational wave source