The nature of Extreme Ultraluminous X-ray Sources
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In this proof-of-concept study we demonstrate that in a binary system mass can be easily delivered toward an accreting compact object at extremely high rates. If the transferred mass is efficiently converted to X-ray luminosity (without disregard of the classical Eddington limit) then binaries can form extreme ULX sources with the X-ray luminosity of $L_X \gtrsim 10^{45} \text{erg s}^{-1}$. Observations of HLX-1 in ESO 243-49 with X-ray luminosity of $1.1 \times 10^{45} \text{erg s}^{-1}$ encouraged us to look into the problem.

Results
- We find several evolutionary channels that lead to phases of an extreme mass transfer rate. These evolutionary phases are extremely short, but they appear in lifetimes of $\sim 0.1\%$ X-ray binaries.

- We found that EULXs may host also NS accretors.
- Even if strong outflows from the accretion disk were present (models S15 and O07), we were able to obtain EULXs.

Ultraluminous X-ray Source
- point-like
- off-nuclear
- $L_X > 10^{45} \text{erg s}^{-1}$
  
More than 470 identified sources (Walton et al., 2011)
Nature still unknown:
1. IMBH (e.g., Colbert & Mushotzky, 1999)
2. super-Eddington accretion (e.g., Motch et al., 2014)

Extreme Ultraluminous X-ray Source
- ULX with $L_X > 10^{45} \text{erg s}^{-1}$
- To date only one EULX, HLX-1 located in ESO 243-49 with $L_X \approx 1.1 \times 10^{45} \text{erg s}^{-1}$

Methodology

Forthcoming Research
Our next goal will be to investigate the population of all ULXs. Our new source of huge computational power (the Universe@home project) will make it possible to calculate a vast grid of models and to perform thorough analysis.

Glossary
AD - Accretion disk
BH - Black Hole
CE - Common Envelope
CH - Common Helium Burning
ULX - UltraLuminous X-ray source
ECS - Electron Capture SN
EULX - Extreme ULX
GB - Giant Branch star
HoGB - Helium Giant Branch star
LBH - Low mass Black Hole
HG - Helium Giant Branch star
MS - Main Sequence
NS - Neutron Star
SN - Supernova
ZAMS - Zero Age Main Sequence

References

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