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Ultraluminous X-ray sources as magnetically powered advective flows around stellar-mass black holes

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Ultraluminous X-ray sources (ULXs) are very bright, off-nuclear, point sources with luminosity exceeding the standard Eddington limit of a stellar-mass black hole (BH). The existing physical scenarios to explain their unusual large luminosity and spectral nature are either super-Eddington accretion around a stellar-mass BH or the existence of the missing class of intermediate-mass BH (IMBH). However, most ULXs with a steep power-law spectrum can be well explained through super-Eddington accretion, while the IMBH scenario has been disputed extensively. Nevertheless, the interpretation of a significant fraction of ULXs with a hard power-law dominated state remains mysterious. For the first time, we have shown that the flow energetics of a magnetically dominated, advective, disc-outflow system around a stellar-mass BH are sufficient to explain the power of ULXs in their hard spectral states. To achieve such large luminosity, the magnetic field of the advective flow has to be larger than the corresponding Eddington magnetic field. Hence, there is neither need to incorporate the contentious IMBH scenarios nor super-Eddington accretions. We suggest that at least some ULXs are magnetically powered sub-Eddington accretors around a stellar-mass BH.

References

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