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Supercritical accretion disks in ultraluminous X-ray sources and SS 433

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Abstract

© 2015 Macmillan Publishers Limited. All rights reserved. The black hole mass and accretion rate in ultraluminous X-ray sources (ULXs) in external galaxies, whose X-ray luminosities exceed those of the brightest black holes in our Galaxy by hundreds and thousands of times, is an unsolved problem. Here we report that all ULXs ever spectroscopically observed have almost the same optical spectra, apparently of WNL type (late nitrogen Wolf-Rayet stars) or LBV (luminous blue variables) in their hot state, which are very scarce stellar objects. We show that the spectra do not originate from WNL/LBV-type donors but from very hot winds from the accretion disks with nearly normal hydrogen content, which have similar physical conditions to the stellar winds from these stars. The optical spectra are similar to that of SS 433, the only known supercritical accretor in our Galaxy, although the ULX spectra indicate a higher wind temperature. Our results suggest that ULXs with X-ray luminosities of $\sim 10^{40}$ erg ssa must constitute a homogeneous class of objects, which most likely have supercritical accretion disks.

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