Thermally driven disk winds in X-ray binaries - radiation-hydrodynamic simulations.

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Abstract

Essentially all low-mass X-ray binaries (LMXBs) in the soft state appear to drive powerful equatorial disc winds. A simple mechanism for driving such outflows involves X-ray heating of the top of the disc atmosphere to high temperatures. At large radii, the thermal speed exceeds the escape velocity, and mass loss is inevitable. Here, we present the first coupled radiation-hydrodynamic simulation of such thermally-driven disc winds. Initially, we have adopted parameters representative of the wind-driving LMXB GRO_~J1655-40 and our model yields a mass-loss rate that is more than twice the accretion rate. This agrees well with the mass-loss rate inferred from Chandra/HETG observations of the source at a time when the system had a similar luminosity to that adopted in our simulations. We also present synthetic line profiles for hydrogen and helium like Iron, which show similar line equivalent widths to the observations, although the outflow velocities are much lower than inferred from observations. We then increase the luminosity towards the Eddington rate, and note that the wind efficiency (wind mass-loss rate/accretion rate) tends to a constant value, although the velocity of the outflow increases with increasing source luminosity.

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