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A mysterious source of fast outflows in a nearby dwarf galaxy: a ULX shrouded by a thick wind or envelope?

There is a mysterious point-like source in the starburst dwarf galaxy NGC 5408. It is the strongest compact radio source in that galaxy (5-GHz flux density of ≈ 2 mJy, corresponding to a luminosity of $\approx 3 \times 10^{35}$ erg s⁻¹). In the optical, it is too bright and too red ($V \approx 19.5$, $R \approx 18.1$, corresponding to $M_V \approx -9$, $M_R \approx -10.4$) to be consistent with any individual star or HMXB or young star cluster. Its optical spectrum is completely dominated by two sets of strong emission lines: broad and narrow. Very broad Balmer and HeI lines imply a dense, powerful and highly variable outflow with speeds of up to $\pm 3,000$ km s⁻¹. Photo-ionized, narrow higher-ionization lines (eg He II 4686) suggest an intrinsic X-ray luminosity of several times 10^{40} erg s⁻¹ (mostly blocked from our view). The amount of power required to explain X-ray and radio emission suggests the presence of a fast-accreting black hole, but the optical spectrum is very different from any previously known ULX. We speculate that it is a rare type of microquasar going through a short-lived evolutionary phase of its massive donor star. The optically thick outflow may come from a super-critical accretion disk or from common envelope ejection, with the large outflow photosphere responsible for the optical continuum (blackbody radius $\approx 1000R_{\odot}$). The radio emission may trace a compact (very young?) shock-ionized bubble.

Contribution

Oral talk

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