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CG X-1: AN ECLIPSING WOLF-RAYET ULX IN THE CIRCINUS GALAXY

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Compact Wolf-Rayet X-ray binaries with orbital periods of less than a day are a rare class of sources, probing a short-lived (few 10^5 yr) but key evolutionary stage of binary systems. They emerge from a common envelope phase and (if they survive the second SN explosion) they form double compact objects that can merge via gravitational decay in less than a Gyr. We studied the candidate Wolf-Rayet X-ray binary CG X-1 in the Circinus galaxy, using 20 years of Chandra and XMM-Newton data. CG X-1 is an eclipsing source and one of the most luminous ULXs in the local universe (peak L_X = 3 x 10^{40} erg/s at a distance of 4.2 Mpc). We phase connected the lightcurves in the archival data and derived a period of (25,970.0 +/- 0.1) s and a period derivative Pdot/P = (10.2 +/- 4.6) x 10^{-7} yr^{-1}. The intriguing dipping and eclipsing behavior of CG X-1 is different from the orbital modulations seen in other classes of X-ray binaries. We suggest that such lightcurves are a defining property of this class of super-Eddington sources, in which both the primary and the secondary launch dense, fast outflows with similar kinetic power. We propose a model for the asymmetric dips and occultations, based on partial covering by Compton-thick clouds. We speculate that the main occulting material is dense, shocked wind between black hole and donor star, and in a bow shock ahead of the black hole.

Topic

Compact and diffuse sources in galaxies and in the Galactic Center

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