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Intriguing eclipses and time variability in 47 Tucanae's quiescent low-mass X-ray binary X5

[Kaur, Ravjit](#) ; [Di Stefano, Rosanne](#)  ; [Kashyap, Vinay](#) ; [McDowell, Jonathan](#)  ; [Dillmann, Steven](#) ; [Patankar, Mihir](#) ; [Das, Rutuparna](#) ; [Ragozzine, Darin](#) [show details](#)

 Abstract

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In external galaxies where stars are so densely packed that they cannot be resolved, and in globular clusters where it is possible but challenging to do so, exoplanets cannot be detected via transits at optical wavelengths. Therefore, X-rays emitted by bright X-ray sources offer a way to detect exoplanets, where the transiting planet blocks the X-rays and produces an eclipse in the light curve. We present a streamlined code for producing X-ray light curves from the Chandra Source Catalog (CSC) event list data. We use that code to produce a catalog of light curves for the X-ray sources in 47 Tucanae (NGC 104), as observed by Chandra X-ray Observatory. We inspect the X-ray light curves for unusual or unexpected transits and dips that may indicate the presence of an exoplanet or third body in the system. We present the results of this initial survey: the quiescent low-mass X-ray binary (qLMXB) 2CXO J002400.9-720453 (X5), which contains one such unusual transit in its light curves, and consider the possibility of it indicating a third body in the system. The SAO REU program is funded in part by the National Science Foundation REU and Department of Defense ASSURE programs under NSF Grant no. AST-2050813, and by the Smithsonian Institution.

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