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Presence of a third body orbiting around XB 1916-053.

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The ultra-compact dipping source XB 1916-053 has an orbital period of close to 50 min and a companion star with a very low mass (less than 0.1 $M_\odot$). The known orbital period derivative $(1.5(3) \times 10^{-11}$ s/s) is extremely large and can be explained by invoking an extreme, non-conservative mass transfer rate that is not easily justifiable. We extended the analysed data from 1978 to 2014, by spanning 37 years, to verify whether a larger sample of data can be fitted with a quadratic term or a different scenario has to be considered. The 27 delays associated with the dip arrival times are well fitted using a sinusoidal term plus a quadratic function or, alternatively, with a series of sinusoidal terms that can be associated with a modulation of the dip arrival times due to the presence of a third body that has an elliptical orbit. We infer that for a conservative mass transfer scenario the modulation of the delays can be explained by invoking the presence of a third body with mass between 0.10-0.14 $M_\odot$, orbital period around the X-ray binary system of close to 51 yr and an eccentricity of 0.28 ± 0.15. In a non-conservative mass transfer scenario we estimate that the fraction of matter yielded by the degenerate companion star and accreted onto the neutron star is $\beta = 0.08$, the neutron star mass is ≥ 2.2 $M_\odot$, and the companion star mass is 0.028 $M_\odot$. In this case, we explain the sinusoidal modulation of the delays by invoking the presence of a third body with orbital period of 26 yr and mass of 0.055 $M_\odot$. From the analysis of the delays, we find that both in a conservative and non-conservative mass transfer scenario we have to invoke the presence of a third body to explain the observed sinusoidal modulation. We propose that XB 1916-053 forms a hierarchical triple system.

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