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Irradiated but not eclipsed, the case of PSR J0610-2100

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In this talk, I will discuss results from radio timing observations of the black widow binary pulsar J0610-2100 and optical observations of its binary companion. The radio timing observations extend the timing baseline to 16 yr and reveal a marginal detection of the orbital period derivative, but they show no significant evidence of orbital variations such as those seen in other black widow pulsars. Furthermore, no eclipses are seen in the observations at observing frequencies ranging from 310 to 2700 MHz. The optical VRI light curves were modulated with the orbital period, reaching maximum brightness of $V=26.8$, $R=25.4$, and $I=23.8$ at superior conjunction of the companion, confirming irradiation of the companion by the pulsar. Modelling the light curves indicates that the companion is likely not filling its Roche lobe, while having a moderate inclination ($i > 54$ degrees). We find an unusually low temperature and a low irradiation for the irradiated hemisphere of the companion. We investigate the absence of radio eclipses in PSR J0610-2100 and in other black widow systems in relation to their binary, pulsar, and companion properties. We also discuss the suitability of PSR J0610-2100 for pulsar timing array observations aimed at detecting nano-Hertz gravitational waves.

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Session Classification: Parallel Session: Compact objects, Stars, & Planets