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Ultraviolet anomalies of the WASP-12 and HD 189733 systems: Trojan satellites as a plasma source

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We suggest an additional possible plasma source in the WASP-12 and HD189733b systems to explain part of the phenomena observed in ultraviolet (UV) light curves during planetary transits. In the proposed scenario, material originates from the molten surface of Trojan satellites on orbits near the Lagrange points L_4 and L_5. We show that the temperature at the orbital location of WASP-12b is high enough to melt the surface of rocky Trojans and to form shallow lava oceans on them. At the orbital distance of WASP-12b, this leads to the release of elements such as Mg and Ca, which are expected to surround the system. The predicted Mg and Ca outgassing rates from two Io-sized WASP-12b Trojans are $\approx 2.2 \times 10^{27}$ s^{-1} and $\approx 2.2 \times 10^{26}$ s^{-1}, respectively. Trojan outgassing can lead to the observed lack of emission in MgII h&k and CaII H&K line cores of WASP-12. For HD 189733b, the mechanism is only marginally possible due to the lower temperature. The early ingress of HD 189733b observed in the far-UV (FUV) CII doublet couldn't be explained by this mechanism due to absence of carbon within elements outgassed by molten lava. We investigate the long-term stability region of WASP-12b and HD 189733b in case of planar and inclined motion of these satellites and show that unlike the classical exomoons orbiting the planet, Io-sized Trojans can be stable for the whole systems life time.