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Dynamical habitability in multi-planetary systems resembling the Solar-system

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The dynamics in our Solar System is certainly dominated by the two giant planets Jupiter and Saturn which are close to the 5:2 MMR (i.e. mean motion resonance). We present a study of different Jupiter-Saturn like configurations – where Saturn's semi-major axis (a_S) and mass (m_S) was varied: a_S between 8 and 11 AU and m_S was increased up to 40 times its mass. The selected range of a_S scans the region between two important low-order MMRs – the 2:1 and the 3:1 MMRs. Within this range several higher order MMRs characterize the motion. For the different configurations the stability of Earth-like planets in the habitable zone (HZ) was examined. The HZ is a defined area for human life near a Sun-like star. In our solar system the HZ reaches from 0.95 AU to 1.37 AU (according to the work by Kasting et al. 1993). In our study the HZ was extended in order to obtain additional information for the positions of Venus and Mars. We will show that the HZ is visibly influenced by MMRs and secular resonances, which might lead to high eccentric motion so that the terrestrial planet will leave the HZ periodically. Therefore, we are able to exclude configurations, since they do not provide the necessary conditions for dynamical habitability.