Binary stars and habitable planets: can 'hostile' environments be less hostile for potentially habitable worlds?

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Abstract

Theoretical studies and observations over the past years have shown that not only is possible to form planets in binary systems but also that double stars can be hosts to habitable worlds. Water is a fundamental element for developing and sustaining life as we know it. Whether a planet can provide favourable conditions for retaining water on its surface depends on many things. In a single star-planet system, habitability is a rather complex matter to be resolved, as there is a large
number of factors that need to be taken into consideration. The situation gets even more perplexed when the planet resides in a stellar binary, either in a circumstellar or a circumbinary orbit. In this work we investigate the hypothesis that the chances of having water on a planet in 'hostile' environments, such as binary systems in dense star-forming regions, can increase as a consequence of physical processes that take place in such environments. Our results indicate that this hypothesis is essentially incorrect. Although certain binary star configurations permit extended habitable zones, such set-ups typically require all orbits in a system to be nearly circular. In all other cases planets can only remain habitable if they display an extraordinarily high climate inertia.

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