An empirical stability analysis of the Caledonian symmetric four-body model

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The Caledonian Symmetric Four Body Problem (CSFBP) is a restricted four body system with a symmetrically reduced phase space which can be applied to study the stability and evolution of symmetric quadruple stellar clusters and exo-planetary systems [1]. Recently we have developed a global regularization scheme that consists of adapted versions of several known regularisation transformations such as the Levi-Civita-type coordinate transformations; that together with a time transformation, removes all the singularities due to colliding pairs of masses [2]. Using this newly developed numerical algorithm, we numerically investigate the relationship between the hierarchical stability of the system and the analytical stability parameter characterised by the Szebehely constant which is a function of the total energy and angular momentum of the system. It is possible to empirically analyse the stability of the CSFBP by studying the hierarchical evolution of a comprehensive set of orbits appearing in the phase space of the CSFBP.

References

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