TRIPLE COLLISION AS AN UNSTABLE EQUILIBRIUM

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ABSTRACT

The family of trajectories near a triple collision solution in the planar problem of three bodies is investigated by means of linearization in the neighborhood of the parabolic free fall. The local topological structure of this family is found to be that of a saddle point in the R^8. The corresponding stable manifold is the set of all triple collision solutions, whereas the instable manifold is formed by the parabolic solutions.

In important cases of nonzero total energy the family of close encounters is quantitatively described in terms of hypergeometric functions. By means of homothetic transformations the close triple encounters are then related to three-body motion with zero energy and zero angular momentum. In this way almost all close encounters near a homothetic solution can be treated by using a small number of particular solutions of the three-body problem that may be calculated once for all.

In practical examples the first order theory presented here predicts the escape velocity after a close triple encounter with a relative accuracy comparable to the closeness of the encounter.

REFERENCES

Waldvogel, J.: 1976, "Triple Collision as an Unstable Equilibrium" submitted to the Académie Royale de Belgique, Brussels.

Waldvogel, J.: 1976, "The Three-Body Problem Near Triple Collision", to appear in Celestial Mechanics.