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Singularities of the curved n-body problem

For the n-body problem in spaces of non-zero constant curvature k, we analyze the singularities of the equations of motion and several types of singular solutions. We show that, for k larger than 0, the equations of motion encounter non-collision singularities, which occur when two or more bodies are antipodal. This conclusion leads, on one hand, to hybrid solution singularities for as few as 3 bodies, whose orbits end up in a collision-antipodal configuration in finite time; on the other hand, it produces non-singularity collisions, characterized by finite velocities and forces at the collision instant.