1135-70-965   **Richard Montgomery*** (`rmont@ucsc.edu`), Math Dept, UCSC, 1156 High Street, Santa Cruz, CA 95064. *Metric Geometry and Marchal's lemma.* Preliminary report.

Excluding collisions from action minimizers is the central problem to be faced in getting variational methods to work for N-body problems. In this regard Marchal's lemma and its generalizations is the most powerful tool. Here we relook at the problem of minimizers approaching collision from the perspective of the Jacobi-Maupertuis [JM] metric. Two salient items arise. (1) If the potential is homogeneous of degree -a, $0 < a < 2$, then the natural metric completion of the JM Riemannian metric has cone-like singularities at collisions. (2) Geodesics ending in collision are inextendible if and only if Marchal's lemma holds for that potential. These observations allow us to construct potentials which are homogeneous of degree -1 for which Marchal's lemma fails. Our work is related to work of Barutello-Terracini and Hu-Yu on anisotropic Kepler problems and the Morse indices of collision solutions. (Received September 18, 2017)

1