Equilibria in Non-Euclidean Geometries

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In this paper, extending the work of Gal'perin [2], we investigate generalizations of the concepts of centroids and static equilibrium points of a convex body in spherical, hyperbolic and normed spaces. In addition, we examine the minimum number of equilibrium points a 2- or 3-dimensional convex body can have in these spaces. In particular, we show that every plane convex body in any of these spaces has at least four equilibrium points, and that there are mono-monostatic convex bodies in 3-dimensional spherical, hyperbolic, and certain normed spaces. Our results are generalizations of results of Domokos, Papadopoulos and Ruina [1], and Várkonyi and Domokos [3] for convex bodies in Euclidean space.

[1] G. Domokos, J. Papadopoulos and A. Ruina., Static equilibria of planar, rigid bodies: is there anything new?, *J. Elasticity* **36(1)** (1994), 59–66.

[2] G. A. Gal'perin, A concept of the mass center of a system of material points in the constant curvature spaces, *Comm. Math. Phys.* **154(1)** (1993), 63–84.

[3] P.L. Várkonyi and G. Domokos, Static equilibria of rigid bodies: dice, pebbles, and the Poincaré-Hopf theorem, *J. Nonlinear Sci.* **16** (2006), 255–281.