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On flat shadow boundaries from point light sources and the characterization of ellipsoids

The study of convex bodies whose hyperplane sections exhibit specific symmetry traces back to the classical works of W. Blaschke and H. Brunn. More recently, in a series of papers by I. Gonzalez-Garcia, J. Jeronimo-Castro, E. Morales-Amaya, and D.J. Verduco-Hernandez, attention has turned to a dual viewpoint: instead of symmetries of sections by a prescribed family of hyperplanes, one investigates symmetries of supporting cones with apexes in a prescribed family of points. In this talk, we will present a precise duality framework that connects known and conjectured results in these two settings. We will further show that if the shadow boundaries generated by point light sources placed on a hypersurface enclosing a sufficiently smooth convex body $K \subset \mathbb{R}^n$, $n \geq 3$, are all flat, then K must necessarily be an ellipsoid. This extends a classical theorem of Blaschke, who established the analogous characterization in the case of parallel light sources placed at infinity.