Marked length spectral invariants of Birkhoff billiard tables and compactness of isospectral sets

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For planar billiard tables, the marked length spectrum encodes the lengths of action (minus the length) minimizing orbits of a given rational rotation number. For strictly convex tables, a renormalization of these lengths extends to a continuous function called Mather's beta function (or the mean minimal action). We show that using the algebraic structure of its Taylor coefficients, one can prove C infinity compactness of marked length isospectral sets. This gives a dynamical counterpart to the Laplace spectral results of Melrose, Osgood, Phillips and Sarnak.