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Isoparametric foliations and the Pompeiu property

Abstract: A bounded domain Ω in $\mathbb{R}^n$ is said to have the Pompeiu property if the only continuous function which has zero integral over all congruent copies of Ω is the zero function. It is known that balls fail the Pompeiu property, and the famous Pompeiu conjecture states that the only domains homeomorphic to a ball doing so are balls. We investigate the analogous problem in the case of domains in compact Riemannian manifolds M admitting an isoparametric foliation, with particular attention to domains of the round sphere. We relate the Pompeiu property with the spectrum of the Laplacian on M, and find precise conditions under which the level domains of an isoparametric function fail the Pompeiu property. In this context, we will also discuss Ungar's "freak theorem about functions on the sphere". This is a joint work with A. Savo.