Seminari di Matematica

Compact Equilibria in the Liquid Drop Model

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Abstract

This work addresses the liquid drop model, introduced by Gamow in 1930 and Bohr–Wheeler in 1939, to describe the structure of atomic nuclei in nuclear physics. The problem involves finding a surface in three-dimensional space that is critical for a specific energy functional, balancing surface tension and nonlocal repulsion, subject to a volume constraint. Spherical solutions always exist and minimize the energy for sufficiently small volumes. However, for larger volumes, constructing non-minimizing critical points becomes more challenging. In this study, we present a new class of large-volume solutions, resembling "pearl collars" arranged along an axis in the shape of a large circle, with geometry close to Delaunay's unduloids-surfaces of constant mean curvature. We also construct non-minimizing solutions with small mass that resemble two nearly identical spheres connected by a narrow neck.
This is collaboration with Monica Musso, Andrés Zúñiga, and Rupert Frank.