Dimension reduction for action ground states on product spaces

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Place : Institut de Mathématiques de Toulouse

Length : at least 4 months

Field : Analysis of PDE

Level : Master 2

Description of the project :

Action ground states are solutions of a variational problem involving the minimization of a functional called *action* over a constraint called the *Nehari constraint*. They are ubiquitous in the analysis of nonlinear dispersive PDE such as Korteweg-de Vries or nonlinear Schrödinger equations.

The goal of this internship is to study action ground states when the underlying space is a product space of the type $\mathbb{R} \times \mathcal{M}$, where $\mathcal{M}$ denotes a compact manifold. One of the key feature that is expected in this framework is a form of rigidity of the minimizers : when the volume of the manifold is very small, the action ground states should be formed by the line $\mathbb{R}$ ground state trivially extended in the transerve direction.

The mathematical tools involved will be functional analysis, Sobolev spaces, compactness arguments and variational techniques.

The topic could be developed into a larger project for a PhD thesis.

– S. Le Coz and B. Shakarov. Ground states on a fractured strip and one-dimensional reduction. Z. Anal. Anwend. (2026), published online first
– A. Szulkin and T. Weth. The method of Nehari manifold. In *Handbook of nonconvex analysis and applications*, pages 597–632. Int. Press, Somerville, MA, 2010.
– S. Terracini, N. Tzvetkov, and N. Visciglia. The nonlinear Schrödinger equation ground states on product spaces. *Analysis & PDE*, 7(1) :73–96, 2014.