



Lehrstuhl für Analysis und Modellierung

**Lehrstuhl-Seminar
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'Mountains out of Magnets' - Existence of Localised Radial Patterns on the Surface of a Ferrofluid

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WebEx

Abstract: Ferrofluids, magnetic fluids consisting of iron nanoparticles, provide a good experimental medium to investigate properties of nonlinear patterns. For a vertically applied magnetic field, there exists a critical field strength at which spikes emerge from the ferrofluid, arranging in domain-covering cellular patterns. In 2005, solitary spikes were experimentally observed; these spikes were not affected by the shape of the fluid's container, and drifted around the domain, indicating they were localised solutions.

In this talk, I will introduce the ferrohydrostatic problem, formulated as a PDE system, and present our formal results for showing the existence of localised radial patterns. This includes the introduction of an appropriate "spectral" decomposition, in order to reduce the problem to infinitely-many ODEs, and employing geometric 'de-singularisation' to identify exponentially-decaying solutions.

In particular, we show the existence of four classes of localised solutions to the ferrohydrostatic problem, and explore the parameter regions in which these localised radial patterns emerge.