Universität Hamburg
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Fakultät für Mathematik, Informatik
und Naturwissenschaften
Fachbereich Mathematik

Donnerstag, den 21. Januar 2027, um 14:30 Uhr, MIN-F, Hörsaal 3

Prof. Dr. Caterina Zeppieri*
(Universität Münster, Institut für Analysis und Numerik)

Homogenisation of droplets in liquid-liquid phase transitions

Zusammenfassung/Abstract:

Many fluid mixtures separate into distinct phases, and in the gradient theory of phase transitions this is described by the Modica–Mortola energy. As the thickness of the diffuse interfaces tends to zero, this energy converges to a sharp-interface model in which only the area of the interfaces matters. In real systems, however, phase separation rarely takes place in a homogeneous environment: impurities may trap one of the phases in many tiny pinned droplets scattered throughout the container.

In this talk I will discuss what happens when a large number of such droplets are distributed randomly in the container. In a critical parameter regime, the droplets do not change the surface tension, but they produce a new bulk term in the limit energy. This term penalises the volume of the other phases, and it bends the interfaces into surfaces of constant mean curvature. Its coefficient is given by a new nonlinear capacity averaged over the random distribution of the droplets.

I will explain how variational convergence and capacity theory combine with ergodic theorems for marked point processes to prove this result.

This is joint work with Adriana Garroni (Sapienza University of Rome) and Konstantinos Zemas (University of Bonn).

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