A weak-strong uniqueness principle for the Mullins–Sekerka equation

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We establish a weak-strong uniqueness principle for the two-phase Mullins-Sekerka equation in ambient dimension $d = 2$ and 3: As long as a classical solution to the evolution problem exists, any weak De Giorgi type varifold solution (see for this notion the recent work with Stinson, Arch. Ration. Mech. Anal. 248, 8, 2024) must coincide with it. In particular, in the absence of topology changes such weak solutions do not introduce a mechanism for (unphysical) non-uniqueness. We also derive a stability estimate with respect to changes in the data. I will explain our method which is based on the notion of relative entropies for interface evolution problems, a reduction argument to a perturbative setting, and a stability analysis in this perturbative regime relying crucially on the gradient flow structure of the Mullins–Sekerka equation.

This is joint work with Julian Fischer, Tim Laux and Theresa M. Simon.