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Refined Jacobian estimates and vortex dynamics for the Gross–Pitaevsky equation

We study dynamics of vortices in solutions of the Gross–Pitaevsky equations on 2-dimensional domains. These equations model certain superfluids, and they contain a dimensionless parameter ε . Results characterizing vortex dynamics in the limit $\varepsilon \rightarrow 0$ have been known since the late '90s. Our results improve on this earlier work in several ways: they are valid for fixed small ε rather than only for a sequence of solutions with ε tending to zero; and they are valid for larger numbers of vortices and longer time scales than previous work. The refined Jacobian estimates mentioned in the title of the talk play a crucial technical role in the proof and are possibly of independent interest.

This is joint work with D. Spirn.