VORTEX DYNAMICS FOR THE GROSS-PITAEVSKII EQUATION

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In this talk we present a rigorous construction of multi-vortex solutions to the Gross-Pitaevskii equation in the plane, verifying formal asymptotics derived by Neu in 1990. Given any integer n > 1, we construct a family of n-vortex solutions with vortices of degree +1 or -1, and describe precisely the solution profile and associated vortex dynamics on an arbitrarily large, finite time interval. We compute an asymptotic expansion of the vortex positions in terms of the vortex core size, and show that the dynamics is governed at leading order by the classical Helmholtz-Kirchhoff system. Moreover, we show that the first correction to the leading order dynamics is determined by the solution of a linear wave equation, justifying a formal expansion found by Ovchinnikov and Sigal. This is joint work with Manuel del Pino and Monica Musso.