On the role of quadratic oscillations in nonlinear Schrödinger equations

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We consider a nonlinear semi–classical Schrödinger equation for which it is known that quadratic oscillations lead to focusing at one point, described by a nonlinear scattering operator. If the initial data is an energy bounded sequence, we prove that the nonlinear term has an effect at leading order *only if* the initial data have quadratic oscillations; the proof relies on a linearizability condition (which can be expressed in terms of Wigner measures). When the initial data is a sum of such quadratic oscillations, we prove that the associate solution is the superposition of the nonlinear evolution of each of them, up to a small remainder term. In an appendix, we transpose those results to the case of the nonlinear Schrödinger equation with harmonic potential.