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*Bose–Einstein condensation: from many quantum particles to a quantum “super-particle” and beyond*

Near absolute zero, a gas of quantum particles can condense into an unusual state of matter, called Bose–Einstein condensation, that behaves like a giant quantum particle. It’s only recently that we’ve been able to make the rigorous connection between the physics of the microscopic dynamics and the mathematics of the macroscopic model, the cubic nonlinear Schrodinger equation (NLS). I’ll discuss joint work with Benjamin Schlein and Gigliola Staffilani on two-dimensional cases of Bose–Einstein condensation—and the periodic case is especially interesting, because of techniques from analytic number theory and applications to quantum computing. As time permits, I’ll also mention work in progress on computational quantum many-body systems and phase transitions for the invariant measures of the NLS.