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Kay L Kirkpatrick* (kay.kirkpatrick@gmail.com). *Bose-Einstein condensation, the NLS, and a phase transition.*

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. Recently we've been able to make the rigorous probabilistic connection between the physics of the microscopic dynamics and the mathematics of the macroscopic model, the cubic nonlinear Schrodinger equation (NLS).

I'll mention joint work with Benjamin Schlein and Gigliola Staffilani on the two-dimensional cases for Bose-Einstein condensation—and the periodic case is especially interesting, because it uses techniques from analytic number theory and has applications to quantum computing. I'll also describe new work with Sourav Chatterjee about a phase transition for the invariant measures of the NLS, work which sheds light on typicality of blow up as well as a controversial conjecture of Lebowitz, Rose, and Speer. (Received September 07, 2010)