Physics Seminar: Vladimir Rosenhaus
Wednesday, May 8 · 1:00 – 2:00pm

Location: 313

Title: Wave turbulence and quantum field theory

Abstract: Wind blows over the ocean, exciting long wavelength waves, whose energy then cascades to shorter wavelength waves. The state is statistically stationary and the measured spectrum of energy per mode is a power law, over some range of scales. At very short scales there is sea foam (whitecaps), and the spectrum is believed to again be power law, but a different power. At long scales the nonlinearity is weak (if the wind is not too strong and the waves are small) and the spectrum can be derived analytically. At short scales the nonlinearity is strong, and one loses analytic control. Wave turbulence has been studied theoretically and experimentally in a wide range of systems for half a century. To date, all theoretical results have been at leading order in the nonlinearity. We demonstrate how wave turbulence — a stochastic classical system — can be turned into a quantum field theory. The computation of the spectrum becomes a problem of computing correlation functions. This gives a scheme for computing beyond leading order in the nonlinearity. We consider wave turbulence in a large N system, allowing us to study strong wave turbulence. We develop the analog of the epsilon expansion, allowing us to go from one power law spectrum in the UV to a slightly different power law in the IR (the analog of flow between critical points).