1077-81-1817    **Umesh Vazirani\***, Computer Science Division, U. C. Berkeley, Berkeley, CA 94720. *How does quantum mechanics scale?*

The quantum description of a system of n spins requires $2^n$ complex numbers. For n $= 500$ this dwarves estimates for the number of particles in the Universe. This simple observation lies at the heart of the extravagant computing power of quantum computers. It also presents a fundamental obstacle to simulating or "solving" general quantum many body system.

Is this exponential scaling real? Can it be experimentally tested? And to what extent is the scientific method valid for many body quantum systems if we cannot even calculate the predictions of the theory? This talk is about a computational approach to these questions.

No prior knowledge of quantum computation or quantum mechanics will be assumed. (Received September 21, 2011)