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Wave function collapse, quantum jumps and Schrödinger’s Ichtyosauria

From the early days of quantum mechanics, leading physicists were concerned about the role played by probabilities and the unphysical nature of the quantum jumps and the collapse of the state of quantum systems subject to measurement. Erwin Schrödinger tried to dismiss these problems by declaring that quantum theory applies exclusively to large ensembles of particles, and that these are governed by mean values and absent of randomness.  As late as 1952, Schrödinger thus claimed the very idea of experiments with single quantum particles to be “*as absurd as the one of raising Ichtyosauria in the Zoo*”.

A variety of single quantum systems are now routinely subject to experimental investigation in the laboratory, and I shall briefly review methods used to control and describe the behavior of these *Ichtyosauria* in the quantum laboratory. I shall then comment on recent extensions to the range of predictions made possible with the quantum formalism and on their relationship to our “understanding of quantum mechanics”. Finally, I shall show examples of how the random jump behavior of quantum systems may truly benefit their applications in crucial technologies such as quantum information processing and quantum metrology.