Assessing the Quality of Quantum Sensors

PAUL A. LOPATA, U.S. Army Research Laboratory, THOMAS B. BAHDER, U.S. Army Aviation and Missile Research, Development and Engineering Center — A general sensor can be modeled in the following way: a well-characterized physical system is prepared in some initial state, the system then interacts with a classical field through a well-understood mechanism, and then a measurement is made on the original system. From this procedure it is possible to infer the characteristics of the classical field. A number of proposals have been made to develop quantum sensors, whose physical systems (which are prepared, interact with the classical field, and are then measured) are quantum mechanical in nature. In this talk I introduce this general description of quantum sensors and demonstrate how the unitary (interacting) dynamics and probabilistic measurements afforded by quantum mechanics can be used to infer the value of a classical field using a Bayesian statistical analysis. I also discuss the use of the mathematical measure of mutual information to compare different sensors.

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