Time Reversed Quantum Metrology

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It is well recognized that quantum physics can be used to build better sensors. Such sensors can be for parameters, like phases, forces, fields that correspond to the unitary evolution of the system or for parameters like absorption, scattering that require description in terms open system dynamics. The framework of the quantum Fisher information enables one to obtain best estimates of the parameters and then one can design experiments that can reach Cramer-Rao bounds. I would highlight the importance of the quantum states used as probes, and the importance of the quantum-ness of the measurement schemes. It turns out that in many cases the schemes based on time reversed metrology saturate Cramer-Rao bounds. I would discuss the importance of squeezed states of bosonic systems like photons, ions and cat states of qubits for metrological applications. I would present results on the quantized motion of trapped ions and on quantum advantage in the determination of phases, absorption and scattering parameters.