Quantum metrology is a novel field in quantum technology which is better understood thanks to some exclusive properties of quantum physics such as entanglement. In this thesis we characterize the metrological usefulnes of the initial states used for metrology based only in few expectation values. This way we avoid the tomography of the state in principal needed to compute the quantum Fisher information, which in principar would requiere an inmense amount of resources in an experiment. We also study some of the most basic setups for multi-parametric estimation. We compute the precisions of the estimation of the gradient of the magnetic field when the state is sensitive to a collective unitary phase-shift. This approach leads to some interesting bounds even when a single ensemble of atoms is used to measure the gradient of a magnetic field.

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Lower bounds on quantum metrological precision

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LOWER BOUNDS ON QUANTUM METROLOGICAL PRECISION

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