Qubit uncertainty

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In this tutorial I discuss the conceptual issues arising with the attempt to quantify error and disturbance in quantum measurements. Focus on the case of qubit observables will allow me to develop relevant concepts and carry out proofs from scratch (thus providing, along the way, a manual for teaching this topic at undergraduate level). Specifically I will formulate and prove tight bounds for preparation uncertainties and joint measurement errors of two qubit observables and show, for the maximally incompatible case, how these results confirm Niels Bohrs intuitive stipulation that the possibilities of measurement (of the values of physical quantities) cannot exceed the possibilities of definition (of such values). The novel measurement uncertainty relations are found (ironically) to be confirmed by recent experiments which were claimed to be demonstrations of a violation of Heisenbergs error-disturbance relation.