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Efficient quantum state-estimation and feedback on trapped ions using unsharp measurement[1] HERMANN UYS, SHAUN BURD, CSIR, National Laser Centre, Pretoria, South Africa, SUJIT CHOUDHARY, SANDEEP GOYAL, THOMAS KONRAD, School of Chemistry and Physics, University of KwaZulu-Natal, Durban, South Africa — Parameter estimation and closed-loop feedback control is ubiquitous in every branch of classical science and engineering. Similar control of quantum systems is usually impossible due to two difficulties. Firstly, quantum phenomena are often short lived due to decoherence, and secondly, attempts to estimate the state of a quantum system through projective measurement, strongly disrupt the dynamics. One alternative is to use unsharp measurements, which are less invasive, but lead to less information gain about the system. A sequence of unsharp measurements, however, carried out in the presence of stronger dynamics, promise real-time state monitoring and control via feedback. Such measurements can be realised by periodically entangling an auxiliary quantum system with the target quantum system, and then carrying out projective measurements on the auxiliary system only. In this talk we discuss an efficient method of estimating both the state of a two-level system and the strength of its coupling to a drive field using unsharp measurement. We then model closed loop feedback control of the two-level dynamics, and explore the level of control over the parameter regime of the model. Finally, we summarize the prospects for implementing the scheme using trapped ions.

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