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## **【524】 Optimal metrology with variational quantum circuits on trapped ions**

*Wednesday, 1 September 2021 18:00 (15 minutes)*

Ensembles of cold atoms and ions excel in metrology and quantum information processing. This opens the opportunity to utilize tailored, programmable entanglement generation to approach the ‘optimal quantum sensor’. Here we report first quantum enhancement in metrology beyond squeezing through low-depth, variational quantum circuits searching for optimal input states and measurement operators. We perform entanglement-enhanced Ramsey interferometry using a Bayesian approach to stochastic phase estimation tailored to the sensor platform. We verify the performance by both directly using theory predictions of optimal parameters, and performing online feedback optimization to ‘self-calibrate’ the variational parameters. We find that variational circuits outperform classical, and direct spin squeezing strategies under realistic noise and imperfections.

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