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**Informationally complete measurements from compressed sensing methodology**[1] AMIR KALEV, University of New Mexico, CARLOS RIOFRIO, Freie Universitat Berlin, ROBERT KOSUT, SC Solutions, IVAN DEUTSCH, University of New Mexico — Compressed sensing (CS) is a technique to faithfully estimate an unknown signal from relatively few data points when the measurement samples satisfy a restricted isometry property (RIP). Recently this technique has been ported to quantum information science to perform tomography with a substantially reduced number of measurement settings. In this work we show that the constraint that a physical density matrix is positive semidefinite provides a rigorous connection between the RIP and the informational completeness (IC) of a POVM used for state tomography. This enables us to construct IC measurements that are robust to noise using tools provided by the CS methodology. The exact recovery no longer hinges on a particular convex optimization program; solving any optimization, constrained on the cone of positive matrices, effectively results in a CS estimation of the state. From a practical point of view, we can therefore employ fast algorithms developed to handle large dimensional matrices for efficient tomography of quantum states of a large dimensional Hilbert space.

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