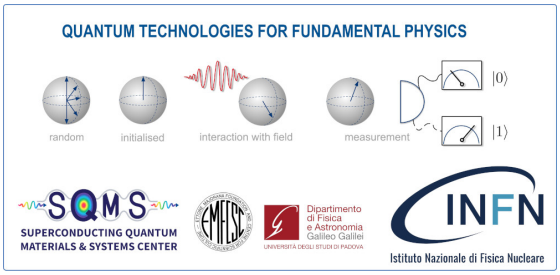

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Quantum metrology of noisy spreading channels

Tuesday, 5 September 2023 11:55 (25 minutes)

We provide the optimal measurement strategy for a class of noisy channels that reduce to the identity channel for a specific value of a parameter (spreading channels). We provide an example that is physically relevant: the estimation of the absolute value of the displacement in the presence of phase randomizing noise. This channel is useful to model axion dark matter search.

Surprisingly, this noise does not affect the effectiveness of the optimal measurement. We show that, for small displacement, a squeezed vacuum probe field is optimal among strategies with same average energy. A squeezer followed by photodetection is the optimal detection strategy that attains the quantum Fisher information, whereas the customarily used homodyne detection becomes useless in the limit of small displacements, due to the same effect that gives Rayleigh's curse in optical superresolution. There is a quantum advantage: a squeezed or a Fock state with N average photons allow to asymptotically estimate the parameter with a N better precision than classical states with same
energy.

Presenter: MACCONE, Lorenzo (Universita' di Pavia)

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