Quantum-Dense Metrology

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Quantum-dense metrology (QDM) constitutes a special case of entanglement-enhanced metrology in which two orthogonal phase space projections of a signal are simultaneously sensed beyond the shot noise limit [1]. In 2013, we showed that the additional sensing channel that is provided by QDM contains information that can be used to identify and to discard corrupted segments from the measurement data. As a potential application, we highlighted the identification of disturbances due to back-scattered light in high-power laser interferometers, such as the GEO600 and AdvLIGO gravitational wave detectors [2] and their future upgrades.
Recently, we proposed and demonstrated a new method in which QDM is used for improving the sensitivity without discarding any measurement segments [3]. Our measurement reached sub-shotnoise performance even though strong classical noise initially polluted the data. Again, applied to the field of gravitational-wave detection, our improved readout could be used to subtract scattering noise shoulders which are known to occur in these detectors, and then go to and beyond the shot-noise limit. The new method has high potential for improving the noise spectral density of gravitational-wave detectors at signal frequencies in the lower audio band, which are of high astrophysical relevance.

References

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