UNIVERSITÀ DEGLI STUDI DI MILANO
DIPARTIMENTO DI FISICA

Friday, 3 October
Aula Polvani

feeding the future with quantum technology

Quantum EXPO

University of Milan - Department of Physics

Rafał Demkowicz-Dobrzański

University of Warsaw

Quantum metrology and decoherence

Scheduled at 11:00

Abstract: Fundamental bounds on precision in realistic quantum metrological protocols will be derived indicating that presence of decoherence makes the quantum precision enhancement offered by quantum metrology less spectacular than in idealized scenarios. Nevertheless, it will be shown that the quantum gain may still be important in practice in e.g. atomic clocks or gravitational wave detectors and can be achieved using experimental resources available today.

"Young scientist seminar"
(scheduled at 11:50)

Claudia Benedetti

University of Milan

Quantum probes for classical complex systems

Lorenzo Maccone

University of Pavia

Quantum metrology, why entanglement?

Scheduled at 14:00

Abstract: In systems with a finite number of degrees of freedom, entanglement can help increase the precision of measurements. However, the reason behind this effect was never analyzed in depth. Here we give a simple, intuitive construction that shows how entanglement transforms parallel estimation strategies into sequential ones of same precision. We can then employ this argument to obtain a series of new results in quantum metrology and also to re-obtain, in a simpler manner, some old ones. What happens in systems (e.g. electromagnetic radiation) with an infinite number of degrees of freedom? It is clear that infinite resources can lead to infinite precision in the measurement, and it has been suggested that infinite phase precision can be achieved using finite energy in interferometric measurements. We prove that this is not true: we give a general bound to the precision of a parameter in terms of the average value of the conjugate observable. Whence, interferometry cannot give infinite precision in phase estimation using finite energy (its conjugate observable). Our inequality is a generalization of the conventional Heisenberg uncertainty relations (and of the Cramér-Rao bounds): there the variance of one parameter is bounded by the variance of a conjugate one. In our bounds, the variance of one is bounded by the average of the other. The same results hold even if one considers the prior information one has on the system.

The talk is based on the results presented in Phys. Rev. A **88**, 042109 (2013); Phys. Rev. Lett. **108**, 260405 (2012); Phys. Rev. Lett. **108**, 210404 (2012).

Further information at the page: http://users.unimi.it/aqm