universität innsbruck

Department of
Theoretical Physics

Theory Colloquium

Karol Gietka, University of Innsbruck

"Anti-Critical Quantum Metrology"

Abstract

Quantum metrology provides tools for estimating physical parameters with very high precision, often beyond what is possible with classical methods. I will begin the seminar with an easy-to-follow introduction to the basics of quantum parameter estimation. This includes the idea of the quantum Fisher information and how it sets the limits of precision. Next, I will discuss critical quantum metrology. In this approach, systems close to a quantum phase transition show a very large quantum Fisher information. This effect comes from the energy gap becoming very small. A small gap, however, means that the system reacts very slowly. This "critical slowing down" makes such schemes difficult to use in practice. I will then introduce anti-critical metrology. This new idea breaks the usual connection between high sensitivity and a closing energy gap. In some interacting quantum systems, the quantum Fisher information can be large even when the gap stays open. Even more surprisingly, a larger quantum Fisher information does not always mean better precision once the full picture is considered. Anti-critical metrology uses this insight to improve precision while the energy gap becomes larger, which avoids long timescales. The idea will be presented using the quantum Rabi model, which provides a clear and practical example of how anti-critical metrology works in interacting quantum systems.

Wednesday | 26.11.2025 | 5:00pm

SR 1 | ICT building