

Seminar

From Atomic Transitions to Global Timekeeping: Precision through Quantum Metrology

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Precise timekeeping underpins a wide range of scientific and technological applications, from tests of fundamental physics to global navigation and communication. Modern time standards are realised using quantum transitions in atoms, which provide intrinsically stable and reproducible frequency references. This talk will outline the evolution of timekeeping from atomic transitions to globally coordinated timescales, emphasizing the role of quantum metrology in achieving high precision. After introducing the operating principles of atomic clocks and primary frequency standards, I will discuss how quantum coherence, interrogation techniques, and noise processes determine clock accuracy and stability. The talk will further introduce the development of optical clocks and their role in next-generation time standards. The talk will conclude with an overview of how individual atomic clocks are compared and combined for global timekeeping, followed by a brief outlook on current challenges and future directions in quantum-enabled timekeeping.

Tuesday, Jan 27th 2026

11:30 Hrs (Tea / Coffee 11:15 Hrs)

Auditorium, TIFRH