

# **CSU PHYSICS COLLOQUIUM**

## **“Quantum Interference of Clocks:**

## **From Eddington’s Enigma to the Quantum Twin Paradox”**

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120 Engineering (Hammond Auditorium)

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### **Abstract**

Gravity and quantum physics are usually relevant at vastly different scales. Nevertheless, quantum phenomena can be affected by gravity, with experimentally accessible signatures. Here I will discuss how general relativistic time dilation affects the dynamics of quantum systems, which results in effects due to the interplay between general relativity and quantum physics, such as gravitationally induced entanglement and decoherence. The analysis requires composite quantum systems, which also sheds new light on a long-standing conundrum going back to Eddington and Clark in 1938: a seeming discrepancy with the mass-energy equivalence in general relativity. I will show how the full mass-energy equivalence is restored from first principles. I will also discuss prospects for experimental verification of the predicted effects due to time dilation with both matter-waves and entangled clocks.

### **Biography**

Igor Pikovski is a theoretical quantum physicist, working as an Assistant Professor at Stevens Institute of Technology and at Stockholm University. His research is in quantum information science and quantum optics theory, with a focus on studying how gravity and quantum physics can meet in experiments. Igor obtained his PhD in 2014 from the University of Vienna and then worked at Harvard University as an ITAMP Postdoctoral Fellow and Branco Weiss Fellow. His main research interest is the intersection between AMO physics and fundamental science, such as studying how to test quantum mechanics at macroscopic scales, how curved space-time affects AMO systems and how new quantum technologies can be used for gravitational wave detection and tests of quantum gravity.

