Contribution ID: **28** Type: **Invited Talk**

Combining energy efficiency and quantum advantage in cyclic machines

Thursday, 11 December 2025 09:30 (50 minutes)

Energy efficiency and quantum advantage are two important features of quantum devices. I will present an experimental realization that combines both features in a quantum engine coupled to a quantum battery that stores the produced work, using a single ion in a linear Paul trap. The quantum nature of the device is first established by observing nonclassical work oscillations with the number of cycles as verified by energy measurements of the battery. In addition, shortcut-to-adiabaticity techniques are applied to suppress quantum friction and improve work production. While the average energy cost of the shortcut protocol is only about 3%, the work output is enhanced by up to approximately 33%, making the machine significantly more energy efficient. I will finally show that the quantum engine consistently outperforms its classical counterpart in this regime.

Presenter: LUTZ, Eric (University of Stuttgart)

Session Classification: Thursday