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Coupling trapped ions to a mechanical oscillator

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Ultracold trapped ions in linear radiofrequency traps are well-established and highly controllable quantum systems with a variety of applications in fields such as precision spectroscopy, cold chemistry, quantum information and optical clocks. Nanomechanical oscillators are highly sensitive objects for the development and implementation of technologies in miniaturized devices. Their nanoscopic size makes them excellent candidates for the study of physics on the border of classical and quantum physics and highly susceptible to very weak forces. This property makes nanomechanical oscillators excellent measuring probes with high sensitivities that enabled the development of devices such as atomic force microscopes.
This project is aimed at the implementation of an ion-nanowire hybrid system to explore new methods of trapped ion state preparation, manipulation and readout via the mutual interaction of its constituents. A charged Ag2Ga nanowire is positioned in close proximity to the trapped ions such that they experience a strong mutual Coulomb interaction. Here, we demonstrate the excitation of the axial ion motion in the classical regime and experimentally determine the coupling between pairs of trapped ions and the mechanical oscillator.

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