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## **【541】 Progress in the quantum control of single molecules**

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The development of methods for coherent manipulation of single isolated molecules has made rapid progress in recent years with exciting applications in the fields of precision spectroscopy, fundamental-physics-theories tests, atomic clocks and quantum-controlled chemistry.

In this talk, I will describe our advances for achieving quantum control over a single molecule. In our experiment, a molecular beam is overlapped with a radio-frequency ion trap. We ionize nitrogen ( $N_2$ ) molecules into a specific rotational-vibrational state. The molecular ion is co-trapped with an atomic ion for ground-state cooling and for molecular-state detection by entangling the molecular state with the atomic-ion motion.

While we use  $N_2^+$  as a prototype molecule, our methods can be extended to a general class of diatomic and polyatomic molecules.

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