CENTER FOR QUANTUM NANOSCIENCE

2024 QNS Colloquium

Ultracold molecules as a new quantum resource

Due to their complex internal structures and strong long-range interactions, diatomic molecules are expected to be a promising platform for quantum simulations/computations. The rotational states of the molecules trapped in an optical tweezer array form qubit states with long coherence time. Entanglement between the molecules can be generated using the strong electric dipole-dipole interactions.
To achieve the molecular quantum platform, the molecules should be prepared at ultracold temperatures. One way to cool the molecules is laser-cooling, the workhorse technique to cool the atoms. Despite the complicated internal structures of molecules, laser-cooling and magneto-optical traps of molecules have been demonstrated for several species, reaching temperatures down to 5 uK.
In this talk, two experiments using ultracold molecules will be introduced. I will first start with the CaF experiment at Harvard, where we confirmed dipolar spin exchange due to the strong interaction between the molecules. Here, rotational states of the molecules are adapted as the qubit states, and each molecule is trapped in an optical tweezer. A two-qubit gate to generate the entanglement is demonstrated between the two molecules with the fidelity of 0.89. In the second part of the talk, I will also briefly introduce a new MgF experiment at Korea University.

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Tues Nov 26th | 17:00 -18:00

B1 Jupiter Seminar Room / ZOOM

Research Cooperation Building , Ewha Womans University
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