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Frenkel biexcitons in optical lattices with polar molecules MARINA LITINSKAYA, PING XIANG, ROMAN KREMS, University of British Columbia — Rotational excitation of ultracold polar molecules trapped on an optical lattice produces rotational Frenkel excitons (collective rotational excitations) [1]. We show that non-linear interactions between these excitons can be tuned by applying a dc electric field. We show that, at electric fields greater than a critical value, rotational Frenkel excitons form bound pairs – biexcitons [2]. Frenkel biexcitons are strongly correlated states of two collective excitations in a molecular crystal, which are exceedingly hard to create and observe in solid-state crystals. We demonstrate that the binding energy of the rotational biexcitons can be controlled by tuning the angle between the applied field and the molecular array. Frenkel biexcitons can be used for many applications ranging from the controlled preparation of entanglement between quasi-particles to the study of bipolarons.

[1] "Frenkel biexcitons in optical lattices with polar molecules," Ping Xiang, M. Litinskaya, R. V. Krems; cond-mat/1112.3942.
[2] "Tunable disorder in a crystal of cold polar molecules," F. Herrera, M. Litinskaya, R. V. Krems, Phys. Rev. A 82, 033428 (2010).

[X] Prefer Oral Session
[ ] Prefer Poster Session

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