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Quantum phases of bosonic polar molecules in optical lattice geometries

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In this talk I will address properties of a gas of polar bosonic molecules confined within single-, bi-, and multi-layer geometries — the molecular dipole moments are aligned perpendicularly to the layers. The results presented are based on Quantum Monte Carlo simulations. I will discuss phases and phase transitions displayed by such systems — with emphasis on solids and supersolids —, and the experimental conditions required to observe such phases. In the single layer geometry, I will focus on how the presence of atoms affects molecular solid phases stabilized by dipolar interactions, while in bi- and multi-layer geometries, my focus will be on the formation of pairs and multimers.