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Abstract for an Invited Paper
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Control of Bosons in a 2D optical lattice with checkerboard staggered field.¹

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I will describe experiments to control the vibrational and spin degrees of freedom of ultra-cold Rb atoms in a novel 2D optical lattice. This unit cell of the lattice can be dynamically transformed between a single-site and two-site configuration, allowing us to manipulate the vibrational degree of freedom of atoms in the unit cell, and merge separated atoms into the same site. In addition, the vector light shift of the optical lattice acts as a Zeeman field for the atoms on every other site of the lattice, providing a checkerboard staggered field. We use this field to control the spins on the two sub-lattices separately. I will also discuss the possibility of using this field to prepare low entropy anti-ferromagnetic states.

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