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Hydrodynamic Spin Lattices PEDRO SAENZ, UNC Chapel Hill, GIUSEPPE PUCCI, Institute of Physics of Rennes, SAM TURTON, ALEXIS GOUJON, RUBEN ROSALES, JORN DUNKEL, JOHN BUSH, MIT — In this talk, we will introduce a hydrodynamic analog system that allows us to investigate simultaneously the wave-mediated self-propulsion and interactions of effective spin degrees of freedom in inertial and rotating frames. Millimetric liquid droplets can walk across the surface of a vibrating fluid bath, self-propelled through a resonant interaction with their own guiding wave fields. A walking droplet, or 'walker, may be trapped by a submerged circular well at the bottom of the fluid bath, leading to a clockwise or counter-clockwise angular motion centered at the well. When a collection of such wells is arranged in a 1D or 2D lattice geometry, a thin fluid layer between wells enables wave-mediated interactions between neighboring walkers. Through experiments and mathematical modeling, we demonstrate the spontaneous emergence of coherent droplet rotation dynamics for different types of lattices. For sufficiently strong pair-coupling, wave interactions between neighboring droplets may induce local spin flips leading to ferromagnetic or antiferromagnetic order. Transitions between these two forms of order can be controlled by tuning the lattice parameters or by imposing a Coriolis force mimicking an external magnetic field.

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