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Simulation of magnetism in a triangular optical lattice PATRICK WINDPASSINGER, JULIAN STRUCK, CHRISTOPH ÖLSCHLÄGER, CHRISTINA STAARMANN, PARVIS SOLTAN-PANAHI, RODOLPHE LE TARGAT, KLAUS SENGSTOCK, Institute of Laser Physics, University of Hamburg — We have realized a quantum simulator for magnetism with scalar bosons in a triangular optical lattice. To this end, we identify the local superfluid phase with a classical spin. By tuning the tunneling matrix elements between neighboring lattice sites in magnitude and sign, we can emulate a large variety of magnetic phases in this lattice geometry. We could confirm all the expected magnetic phases, ranging from ferromagnetic via parallel- and staggered-spin-chains to mixed anitferromagnetic-ferromagnetic phases and fully antiferromagneitc systems. In the latter case, we could even observe spin frustration which leads to spontaneous symmetry breaking.
We will present the experimental results obtained for the relevant regions of the spin-phase diagram together with a discussion on the technical realization of the spin-emulator. These results open the perspective to extremely complex and yet not well understood phases like the spin-liquid in a quantum xy-model and the dynamics of different types of phase transitions.

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