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Phases, RK Points and Possible Deconfined Transitions in a Model of Bosons on the Honeycomb Lattice ASHVIN VISHWANATH, CENKE XU, JOEL MOORE, UC Berkeley — We consider a model of hard-core bosons (or S=1/2 spins) on the sites of the honeycomb lattice with an interaction that favors exactly three bosons per hexagon. A rich phase diagram of insulating states is obtained, which includes a solvable point of the Rokhsar-Kivelson type where the ground-state wavefunction is related to a constrained version of the three-color model. On introducing charge fluctuations a superfluid phase obtains. We study transitions between the different insulating phases and between the superfluid and insulating states utilizing a duality due to Motrunich. The unusual aspect of these transitions is that when continuous, they lead to 1/3 charged fractional excitations and an emergent U(1)xU(1) gauge structure in the vicinity of the critical point. The phase diagram of this model makes it a promising candidate for numerically studying 'deconfined' quantum criticality using Quantum Monte Carlo techiniques.

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