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Anomalous superfluidity in two dimensional spin-1 systems[1]
SHAILESH CHANDRASEKHARAN, Duke University — We study thermodynamics of a strongly coupled lattice gauge system in $2+1$ dimensions. The partition function of our model can be written elegantly as a statistical mechanics of dimers and loops. The model is invariant under an $SO(3) \times U(1)$ symmetry which makes it interesting in describing phase transitions in spin-1 systems. At low temperatures, we find evidence for superfluidity in the $U(1)$ symmetry sector while the $SO(3)$ symmetry remains unbroken. The finite temperature phase transition belongs to the Kosterlitz-Thouless universality class, but the superfluid density jump $\rho(T_c)$ at the critical temperature Tc is anomalously higher than the normal value of $2Tc/\pi$. We show that by adding an $SO(3)$ symmetry breaking term to the model, one can obtain a variety of superfluid density jumps, including the normal jump and four times the normal jump that arises in the presence of half vortices. We believe the presence of spin causes the anomalous superfluid behavior seen. Our results may be of interest to researchers studying superfluidity in spin-1 systems. Our work is published in PRL 97, 182001 (2006).

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