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**Examining an Exactly Solvable First-Order Transition in a Modified Hubbard Model** PAWEL PISARSKI, R.J. GOODING, Dept. of Physics, Queens U., Kingston ON — A previous study (PRB **63**, 035014 (2000)) of the success of the different diagrammatic theories in reproducing the physics of the Hubbard model led to the introduction of a modified Hubbard interaction, the latter of which is given by $U\ \sum_i ((\hat{n}_{i,\uparrow} - \langle(\hat{n}_{i,\uparrow}\rangle)\ ((\hat{n}_{i,\downarrow} - \langle(\hat{n}_{i,\downarrow}\rangle))$. We show that the Hubbard model with this modified interaction leads to an exact phase diagram corresponding to a first-order phase transition, with a thermodynamic potential of the same form as that found for the familiar van der Waals equation of state. Then we show that the fully self-consistent T-Matrix Approximation for the repulsive Hubbard interaction accurately tracks the low electron density regime, and that *two* self-consistent solutions are found, corresponding to both the stable and metastable phases of this model. This is in contract to the minimally self-consistent T-Matrix theory that was shown to be successful for the attractive model (PRB **71**, 155111 (2005)).

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