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Multicritical Bifurcation and Weak First-order Phase Transition in a Three-dimensional, Three-state Ising Antiferromagnet[1] DANIEL SILVA, PER ARNE RIKVOLD, Florida State University — The Blume-Capel model generalizes the Ising model to three states, $\{-1, 0, +1\}$, with one interaction constant, J, and two fields: H controlling the $+1/-1$ balance, and D controlling the density of "vacancies (0). The antiferromagnetic (AFM) version ($J < 0$) possesses surfaces of second-order phase transitions between ordered AFM phases and a disordered phase at high temperature, and one of first-order transitions separating the ordered phases from a uniform phase of mostly 0 at large D. These surfaces join smoothly along a line of tricritical points. In 3D (but not in 2D), this line bifurcates into a line of critical end points and a surface of weak first-order transitions [J.D. Kimel and Y.L. Wang, J. Appl. Phys. 69, 6176 (1991)]. We consider the bifurcation region for 3D in detail by standard Monte Carlo simulations of lattices up to 32^3 sites. Phase transitions were identified using finite-size scaling of order-parameter histograms, susceptibilities, and fourth-order cumulants. We identify the two phases separated by the first-order surface as two AFM ordered phases, one with a low vacancy density at temperatures below the transition, and one with a higher vacancy density above the transition. The density changes abruptly across the transition.

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