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The existence of maximally multipartite entangled states of N particles may depend on their spin JAY LAWRENCE, University of Chicago and Dartmouth College, MARIO GAETA, ANDREI KLIMOV, University of Guadalajara, Jal., Mexico — Maximally multipartite entangled states (MMES) are defined [1] as pure states of N particles for which all subsystems consisting of up to half the particles (k=[N/2]) are maximally mixed ($\rho_k \sim I$). Such states exist for two- or three-particle systems (Bell states for N=2 and GHZ states for N=3), and this holds for any spin. The situation changes for four particles, where MMES states do not exist for spin-1/2 (dimension d=2), but they do exist for all odd prime dimensions d [or spins S = (d-1)/2]. The latter systems exhibit three types of graph states, the GHZ and cluster states accessible to qubits, which are not MMES, but also a third type, called P states [2], that are MMES but are not accessible to qubits. We show how the P states succeed while GHZ and cluster states fail by comparing (i) the reduced states of subsystems, and (ii) the measurement-induced pathways which project Bell states of any two particles. We discuss the possibilities that similar transitions exist for larger systems, for which it is known [1] that MMES do not exist for eight or more qubits. 1. L. Arnaud and N.J. Cerf, Phys. Rev. A **87**, 012319 (2013), 2. J. Lawrence, Phys. Rev. A **84**, 022338 (2011).

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