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Ising critical exponents of the frustrated spin-1/2 Heisenberg FM/AF square bilayer in a magnetic field

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The highly frustrated spin-1/2 Heisenberg FM/AF square bilayer in a magnetic field with the ferromagnetic inter-dimer interaction and the antiferromagnetic intra-dimer interaction is explored by the use of localized many-magnon approach, which allows to connect the original purely quantum Heisenberg spin model on a square bilayer with the effective ferromagnetic Ising model on a simple square lattice. Basic magnetic quantities (magnetization, susceptibility, specific heat) are investigated in the proximity of a field-driven phase transition from the singlet-dimer phase towards the fully saturated ferromagnetic phase, which changes from the discontinuous phase transition to the continuous one at a certain critical point. The mapping correspondence between the spin-1/2 Heisenberg FM/AF square bilayer and the ferromagnetic Ising square lattice suggests for this special critical point of the spin-1/2 Heisenberg FM/AF square bilayer critical exponents from the standard two-dimensional Ising universality class.

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