

## **Phase diagrams and thermodynamics of the mixed spin-1/2 and spin-1 Ising model with a spin-phonon interaction**

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The mixed spin-1/2 and spin-1 Ising model on a decorated square lattice partially amenable to lattice vibrations is exactly treated by making use of the canonical coordinate transformation and the decoration-iteration transformation in the spirit of the harmonic approximation. It is shown that the magnetoelastic coupling gives rise to an effective three-site four-spin interaction and single-ion anisotropy, which compete with the nearest-neighbour interaction and are thus responsible for a unusual spin frustration of the decorating spins. Apart from the usual ferromagnetic (ferrimagnetic) phase one consequently finds a striking partially ordered and partially disordered phase, where a perfect antiferromagnetic alignment of the Ising spins from the nodal sites of a square lattice is accompanied with a partial disorder of the decorating spins.

Exact results for the ground-state and finite-temperature phase diagrams are presented along with thermal dependences of the spontaneous magnetization and the specific heat. It is demonstrated that diverse thermal variations of the heat capacity may result from the mutual interplay of lattice and magnetic contributions to the overall specific heat, which may include besides the logarithmic singularity an additional round maximum emerging either in the low- or high-temperature tail of the specific heat. In addition, the effect of magnetoelastic coupling and uniaxial single-ion anisotropy on the critical behaviour is investigated in detail.

Acknowledgment: This work was partially supported under the grant VEGA 1/0234/12.