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Nematic spin order and spin-lattice coupling in Fe-based Superconductors JIANGPING HU, CHEN FANG, WEI-FENG TSAI, Purdue University, HONG YAO, STEVE KIVELSON, Stanford University — We show that the structure transitions observed in Fe-based superconductors are magnetically driven. A quantum Heisenberg model ($J_1 - J_2 - J_z$) exhibits a sequence of two phase transitions: from a high temperature symmetric phase to a narrow region of intermediate "nematic" phase, and then to a low temperature spin ordered phase when J_z is small. Identifying phases by their broken symmetries, these phases correspond precisely to the sequence of structural (tetragonal to monoclinic) and magnetic transitions that have been recently revealed in neutron scattering studies of 1111 series of Fe- based superconductors. The structural transition can thus be identified with the existence of incipient ("fluctuating") magnetic order. We also discuss the effect of spin-lattice coupling on the phase diagram of the model.

Reference: Chen Fang, Hong Yao, Wei-Feng Tsai, JiangPing Hu and Steven A. Kivelson, Phys. Rev. B 77 224509 (2008).

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