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Magnetic and Ising quantum phase transitions in a model for isoelectronically tuned iron pnictides JIANDA WU, Univ of California - San Diego, QIMIAO SI, Rice Univ, ELIHU ABRAHAMS, Univ of California - Los Angeles — Considerations of the bad-metal behavior led to an early proposal for a quantum critical point under a P for As doping in the iron pnictides [1], which has since been experimentally observed [2]. We study here an effective model for the isoelectronically tuned pnictides using a large- N approach [3]. The model contains antiferromagnetic and Ising-nematic order parameters appropriate for J_1 - J_2 exchange-coupled local moments on an Fe square lattice, and a damping caused by coherent itinerant electrons. The zero-temperature magnetic and Ising transitions are concurrent and essentially continuous. The order-parameter jumps are very small, and are further reduced by the inter-plane coupling; quantum criticality hence occurs over a wide dynamical range. Our results provide the basis for further studies on the quantum critical properties in the P-doped iron arsenides. [1] J. Dai, Q. Si, J-X Zhu, and E. Abrahams, PNAS, 106, 4118 (2009) [2] J. Analytis et al, Nature Phys. 10, 194 (2014) ; T. Shibauchi et al., Ann. Rev. Cond. Matt. Phys. 5, 113 (2014); C. de la Cruz, et al., Phys Rev Lett, 104, 017204 (2010). [3] J. Wu, Q. Si, and E. Abrahams, arXiv:1406.5136.

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