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Multi-pole orders and Kondo screening: Implications for quantum phase transitions in multipolar heavy-fermion systems HSIN-HUA LAI, EMILIAN NICA, QIMIAO SI, Department of Physics and Astronomy, Rice University — Motivated by the properties of the heavy-fermion Ce3Pd20Si6 compound [1] which exhibits both antiferro-magnetic (AFM) and antiferro-quadrupolar (AFQ) orders, we study a simplified quantum non-linear sigma model for spin-1 systems [2], with generalized multi-pole Kondo couplings to conduction electrons [3]. We first consider the case when an SU(3) symmetry relates the spin and quadrupolar channels. We then analyze the effect of breaking the SU(3) symmetry, so that the interaction parameters in the spin and quadrupolar sectors are no longer equivalent, and different stages of Kondo screenings are allowed. A renormalization group analysis [4] is used to analyze the interplay between the Kondo effect and the AFM/AFQ orders. Our work paves the way for understanding the global phase diagram in settings beyond the prototypical spin- cases. We also discuss similar considerations in the non-Kramers systems such as the heavy fermion compound PrV2Al20 [5]. [1]Custers et al, Nat.Mater. 11, 189 (2012). [2]A. Smerald et. al., Phys. Rev. B 88, 184430 (2013);Phys. Rev. B 91, 174402 (2015). [3]O. Parcollet et. al,, Phys. Rev. Lett. 79, 4665 (1997);Phys. Rev. B 58, 3794 (1998) [4]Yamamoto S.J. and Q. Si, Phys. Rev. B 81, 205106 (2010). [5]Y. Shimura et. al., Phys. Rev. B 91, 241102(R) (2015)

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