Homework Six, Physics 242, Spring 2009
Due Friday, June 12

[1.] Solve *either* the one site Kondo *or* the one site Anderson Hamiltonian. That is, compute all the eigenenergies of the 8 (Kondo) or 16 (Anderson) dimensional Hilbert space.

$$H^{\text{1 site}}_{\text{Kondo}} = \frac{J}{2}\Big[S^z(c^\dagger_\uparrow c_\uparrow - c^\dagger_\downarrow c_\downarrow) + S^+ c^\dagger_\downarrow c_\uparrow + S^- c^\dagger_\uparrow c_\downarrow\Big] \ . \tag{1}$$

Here S is a spin-1/2 operator and $c, c^\dagger$ are fermion destruction(creation) operators.

$$H^{\text{1 site}}_{\text{Anderson}} = V\sum_\sigma (c^\dagger_\sigma d_\sigma + d^\dagger_\sigma c_\sigma) + U d^\dagger_\uparrow d_\uparrow d^\dagger_\downarrow d_\downarrow + E_d(d^\dagger_\uparrow d_\uparrow + d^\dagger_\downarrow d_\downarrow) \ . \tag{2}$$

Here $c, c^\dagger$ and $d, d^\dagger$ are fermion destruction(creation) operators. Note: You may encounter (cubic) equations which are not analytically tractable. If that happens, just leave the characteristic equation as a cubic or whatever. It may be that a special choice of E_d (such as $E_d = U/2$) makes the mathematics more simple for the Anderson case. (This is called the 'symmetric' form of the model and has some special properties.)

[2.] Discuss (two paragraphs) the nature of the magnetic order in the iron pnictides. Which atoms are magnetic? What is their moment? How are the moments aligned (antiferromagnetic? ferromagnetic?). What is(are) numerical value(s) for the exchange constant(s)? What is the magnetic transition temperature? What experiments give this information?