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## Theory of anomalous properties due to electron-rattling-mode interaction in filled-Skutterudite compounds

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We present a plan of research of our two-years project by briefly reviewing previous developments. First, we discuss the problem of local electron-phonon coupling system in relation to the model for anomalous properties of A15 compounds [1,2]. It is crucial that the fixed point is given by the strong coupling fixed point of the two-level Kondo system, if the local electron-phonon coupling is strong enough [3,4]. This has some relevance to the problem of rattling motion of R-ion interacting with conduction electrons in the filled Skutterudites. Then, the variety of non-trivial phenomena due to the rattling modes are expected even in the filled skutterudite compounds without f-electrons.

Second, as research plans for these two years, the following three points will be addressed:

- 1) NRG analysis of impurity 4-level system in electron gas.
- 2)  $d = \infty$  approach for 4-level lattice on the basis of NRG analysis given in 1).
- 3) Study of possibility of large mass enhancement and unconventional superconductivity mediated by rattling modes.

[1] C. C. Yu and P. W. Anderson, Phys. Rev. B **29** (1984) 6165.

[2] T. Matsuura and K. Miyake, J. Phys. Soc. Jpn. **55** (1986) 610.

[3] H. Kusunose and K. Miyake, J. Phys. Soc. Jpn. **65** (1996) 3032.

[4] S. Yotsuhashi, M. Kojima, H. Kusunose and K. Miyake, to be submitted to “special issue of JPSJ for 40th anniversary of Kondo effect”.