

High-rank multipolar ordering in f -electron systems

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Recently found high-rank multipolar ordering in f -electron systems will be reviewed. For example, 1) odd parity rank-5 (electric dotriacontapole) ordering is likely in URu₂Si₂ [1], which is known as "hidden ordering"; 2) even parity rank-3 (magnetic octupole) ordering in NpO₂ is now well-established [2, 3]. Such a high-rank multipolar ordering with high symmetry is sensitive to symmetry-breaking field and change of relevant interaction. Therefore, comparing to usual dipolar ordering, there are various spin and orbital concerned responses of multipolar ordering to external field *e.g.* magnetic field, pressure, uni-axial stress etc. Some examples of these responses will be addressed.

- [1] S. Kambe et al, Phys. Rev. B. 97, 235142 (2018).
- [2] Y. Tokunaga et al, Phys. Rev. Lett. 97, 257601 (2006).
- [3] J. A. Paixao et al., Phys. Rev. Lett. 89, 187202 (2002).