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# Unique Neutrons: the method for magnetoelastic effects

*Tuesday, 10 December 2019 13:00 (30 minutes)*

Modern condensed matter physics theories are using several assumptions, allowing to solve quantum mechanical problems otherwise hardly solvable. One of them is Born-Oppenheimer approximation: "we can separate motion of nuclei and motion of electrons"[1]. It is known for decades that there exist materials with strong magnetoelastic (ME) coupling, where approximation is no longer valid. However, these were treated as exceptional cases until recently.
Our pioneering research on intermetallic heavy fermion CeAuAl3 pointed out, that ME coupling is far more common than previously believed and even for weakly ME coupled materials hidden modes influencing its ground state can be present [2]. One of the reasons why this effect was not discovered before is its difficult detection. If you want to measure some effect, your probe must have comparable mass/energy with studied phenomena. It is extremely challenging to directly see crosstalk between electrons and lattice vibrations (phonons) because nuclei are thousand times heavier than electrons. Neutron scattering is probably the only suitable method, thanks to neutron mass and spin.
Consequence: Modern synchrotron sources can substitute neutron measurements in many ways, but observation of electron-phonon coupling will probably never be possible with X-Rays. We should keep it in mind and advertise neutrons correspondingly. Come to the talk and learn more!

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