Microscopic Dynamics of ^{3}He in Two and Three Dimensions

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We have developed a systematic and manifestly microscopic theory of the dynamics in ^{3}He. Our description builds upon the concept of dynamic multi-particle fluctuations which has provided a quantitative picture of the phonon/maxon/roton spectrum of ^{4}He far beyond the roton wave-number. The theory includes both, energy-dependent effective interactions and a self-consistent single particle spectrum.
A crucial neutron scattering experiment[1] measuring the dynamic structure function of two-dimensional ^{3}He shows that an equivalent of the roton minimum can indeed appear *below* the particle-hole continuum. This effect is correctly reproduced by our theory, whereas the the textbook concept of assuming that the location of the collective mode is determined by the quasiparticle effective mass is inconsistent with experiments.
Our calculations also clarify a controversy[2] that was raised in recent X-Ray experiments on 3D ^{3}He whether or not the zero sound mode at intermediate wave-vectors is Landau damped.

[1]H. Godfrin *et al.*, contribution to LT26
[2]F. Albergamo, R. Verbeni, S. Huotari, G. Vankó, and G. Monaco, Phys. Rev. Lett. **99**, 205301 (2007), *ibid.* **100**, 239602 (2008), A. J. M. Schmets and W. Montfrooij, Phys. Rev. Lett. **100**, 239601 (2008).