Density and spin–density fluctuations in liquid ^{3}He

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A manifestly microscopic theory of the dynamic structure function of strongly correlated fermions at absolute zero is developed. We employ a variational approach in terms of single– and double–pair fluctuations from the correlated ground state to derive and solve equations of motion for density and spin-density fluctuations as measured in neutron scattering off liquid ^{3}He.[1]
Improvement upon recent calculations for the density channel[2] is accomplished by explicitly including exchanges, dynamic interactions and self-energy terms. The resulting dynamic structure function clearly shows the importance of pair fluctuations, *i.e.* intermediate states that cannot be described by the quantum numbers of a single particle, to capture the relevant physics properly.
Within this framework both spin-spin and density-density response functions are obtained in quantitative agreement with experiments.

1. H. R. Glyde *et al.*, Phys. Rev. B 61, 1421 (2000)
2. H. Böhm *et al.*, Phys. Rev. B 82, 224505 (2010)

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