Multimode–excitations in liquid ^{4}He above the phonon-roton spectrum: Experiments and Theory

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The dynamic structure factor of liquid ^{4}He shows above the familiar phonon–roton spectrum a weak, but rich structure which can be attributed to the decay of induced density fluctuations into elementary excitations. Recent high–precision neutron scattering experiments at very low temperatures[1] and parallel theoretical calculations[2] show clear features such as (a) an extension of the phonon branch into the continuum, (b) the extension of the Pitaevskii–plateau to long wave lengths, and, for the first time, (c) the "Cherenkov" decay of a R_+-roton into a long–wavelength phonon and a lower–energy R_+ roton[3] around saturation density.

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