Bose-Einstein Condensation in Liquid Helium under Pressure

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We report neutron scattering measurements of the Bose-Einstein condensate fraction, n_0, the atomic momentum distribution and of Final State effects in liquid helium as a function of pressure, from p = 0 to 24 bar. Measurements in both the superfluid phase at low temperature and in the normal liquid phase have been made. The measurements were made on the MARI instrument at ISIS. We find that the condensate fraction decreases with increasing pressure, from 7.25 ± 0.75 % at p= 0 (saturated pressure) to 3.2 ± 0.75 % at 24 bar which extrapolates to 3.0 % at the liquid-solid interface (25.3 bar). The atomic momentum distribution broadens with increasing pressure (i.e. the kinetic energy increases). The atomic momentum distribution differs significantly from a simple Gaussian function with high occupation of low momentum states as may be expected for a cold quantum liquid. The deviation from a Gaussian remains largely independent of pressure. Similarly, the Final State (FS) broadening function broadens further with increasing pressure. Comparisons with previous measurements, theory and Monte Carlo calculations will be made.