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Phonon-roton modes and a Bose glass phase in nanoscale liquid ^{4}He JACQUES BOSSY, Institut Neel, CNRS-UJF,Grenoble, JONATHAN PEARCE, National Physical Laboratory, UK, SCHOBER HELMUT, Institut Laue Langevin, Grenoble, HENRY GLYDE, University of Delaware — We present neutron scattering measurements of the elementary phonon-roton modes of liquid ^{4}He confined in nanoporous media. The aim is to compare phonon-roton (P-R) and superfluid density measurements in helium at nanoscales and in disorder. A specific goal is to determine the region of temperature and pressure in which well defined phonon-roton modes (and therefore BEC) exist and compare this with the superfluid region. In 25 $\mathring{A}$ mean pore diameter gelsil Yamamoto et al.[1] find that the superfluid phase extends up to a temperature $T_c = 1.4$ K at saturated vapor pressure (SVP) (p $\simeq 0$) and up to a pressure $p_c = 34$ bar at (T $\simeq 0$). There is apparently a Quantum Phase Transition at $p_c = 34$ bar[1]. We find well defined P-R modes (BEC) extend above T_c at SVP (up to $T_\lambda = 2.17$ K) and to pressures above p_c (up to a pressure p = 36.3-36.8 bars at T $\simeq 0$ but no modes above this pressure). This suggests that there is a Bose glass phase consisting of local regions of BEC (fragmented BEC) separated by regions with no BEC surrounding the superfluid phase at all p and T. We compare this phase diagram with other dirty Bose systems. [1] Yamamoto et al. Phys. Rev. Lett. 93, 075302 (2004).

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