^{3}He-^{4}He liquid mixtures investigated by neutron imaging technique at low temperatures

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Helium is a unique element which exhibits a variety of different phases and unusual behaviors. It can be found in nature in two stable isotopic forms: ^{3}He and ^{4}He. One of the most profound quantum mechanical effects, superfluidity, occurs below 2.17 K in liquid helium ^{4}He and 0.003 K in liquid ^{3}He. There are also interesting phenomena occurring in mixtures of the two isotopes. One demonstrative example is the finite solubility of liquid ^{3}He (a Fermi system) in superfluid ^{4}He (a Bose system) even at T = 0 K. This is the basic principle in the operation of a ^{3}He-^{4}He dilution refrigerator capable of continuously producing 2 mK. While much has been done in studies of the thermodynamical, quantum properties of liquid helium mixtures, there has not been any attempt to visualise the dynamics of ^{3}He in liquid ^{4}He.
Presented results of neutron imaging experiments on 0.3 bar liquid ^{3}He-^{4}He mixtures, at 1.5 K have shown a clear diffuion of ^{3}He driven by the difference in chemical potential. The data were taken for over 12 hours using a high resolution CCD camera.