Session 26bA

Limits of metastability of liquid helium

26bA1

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Helium can remain in the liquid state at a pressure below its saturated vapour pressure or above its melting pressure. This metastability can reach high degrees in helium because of its purity. We review the present knowledge of the stretched liquid state; experiments on cavitation are interpreted in relation to the existence of a liquid-gas spinodal limit. In view of recent experiments, we also consider overpressurized liquid helium 4 and address the question of the stability of the superfluid phase against the solid.

Faceting and growth kinetics of ^{3}He crystals

26bA2

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We have imaged ^{3}He crystals at $T < 1$ mK and identified more than ten different types of facets. These findings make ^{3}He crystals a good system to study faceting because only three types of facets have been found in both ^{3}He and ^{4}He before our experiments. We present data on faceting and growth kinetics and discuss consequences of our results as well as possible future experiments.

26bA3 Melting and Growth of Solid ^{4}He by Ultrasound

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Solid-liquid interface of ^{4}He was prepared between two transducers and ultrasound was applied to it perpendicularly. Solid ^{4}He was grown when the ultrasound was applied to the interface from the solid side and melted from the liquid side at low temperatures below 750mK. Above 750mK it was melted in the both sound directions. These growth and melting are explained qualitatively by the acoustic radiation pressure and the temperature dependent sound transmission coefficients. By using this new way of operating the interface the mobility of the interface was measured in growing and melting cases separately and found to have different values in some crystal orientations.

26bA4 Hyperbolic roton and solid nucleation in superfluid ^{4}He

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The solidification model for superfluid ^{4}He is reviewed, where the symmetry breaking order parameter η is appropriately defined and included in addition to the density change ξ. As a remarkable feature, the model explicitly shows that the instability to the solid is associated with the instability against the fluctuation of η, namely the softening of 'hyperbolic roton'. The rate W of solid nucleation is calculated based on the model. In contrast to ξ, η is non-conserved quantity, and then it leads the novel exponents in W near the spinodal pressure.