Phase Transitions and Crystal Dynamics at low Temperature of Alpha-U and ^{4}He

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Uranium metal includes temperature dependent elastic constants with the occurrence of a charge-density wave (CDW). At $T_0 < 43$ K (lower limit of stability of the structure) a transition involving modes for which $\mathbf{q_{CDW}} = <q_x, q_y, q_z>$ occurs. Domains are formed in different parts of the crystal in relation with the lowering of symmetry. The electronic instability which causes Kohn anomaly also triggers the displacive (Peierls) transition. The band gap created at the Fermi surface geometry determines the wave vector of the Kohn anomaly and of the incommensurable distortion. Inelastic neutron scattering[1)] has confirmed the existence of a transition to the incommensurate low-temperature condensing soft mode with a modulation wave vector $\mathbf{q}_{min}$ = [0.497 (1), 0.13 (1), 0.21 (1)]. The helicoidally motion of $\mathbf{q_{CDW}}$ (43 → 20 K) to the clock-side around $\mathbf{a}^*$(measured by Laue elastic diffraction) has been observed in continuity of the variation of $\mathbf{q}_{min}$ (65 → 44 K) (recently measured inelastic scattering with three–axis spectroscopy) and $\mathbf{q}_{min} \cong \mathbf{q_{CDW}}$ at $T_0 = 43$ K.

In situ phase transition from solid α (hcp) –to– solid γ (bcc) occurring in pure ^{4}He has been investigated in (P, T) plane at 27.5 bar, 1.65 K, by neutron three–axis spectrometer and Laue diffraction. Dynamic solid – solid transformation[2)] of mosaic crystal grains were clearly observed with the two techniques continuously followed in time and observed as motion of macroscopic small angle grain boundaries of quantum crystal.

[1] Marmeggi J.- Cl., et al., *J. Phys. Soc. Jpn*, 2001, A**70**, 22-24 [2] Pelleg O., et al., *submitted for publication.*

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