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Quantum Plasticity and Supersolid Response in Helium-4[1] ANATOLY KUKLOV, Department of Physics & Engineering, College of Staten Island, CUNY, LODE POLLET, Department of Physics, Arnold Sommerfeld Center for Theoretical Physics and Center for NanoScience, University of Munich, NIKOLAY PROKOF'EV, BORIS SVISTUNOV, Department of Physics, University of Massachusetts, Amherst — We argue that the three key phenomena recently observed in solid ^{4}He —mass supertransport, anomalous isochoric compressibility (syringe effect), and giant plasticity—are closely linked to each other through the physics of an interconnected network of tilted quantum-rough gliding and superclimbing dislocations. Such roughness is guaranteed, on one hand, by tilting of dislocations in Peierls barrier, and, on the other, by fast tunneling of kinks and jogs. Quantum rough gliding or superclimbing dislocation features 1D quantum liquid of kinks or jogs, respectively. As immediate implications of this connection several predictions follow: In the absence of ^{3}He impurities, the syringe effect and giant plasticity persist down to $T = 0$; the dynamical low-frequency syringe and giant-plasticity responses are dispersionless; and similarly to giant plasticity but without direct relationship to the supertransport along the dislocation cores, ^{3}He impurities should suppress the syringe effect partially or completely at appropriately low temperatures.

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