Abstract Submitted
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**The properties of dislocations in $^4$He crystals**[1] SEBASTIEN BALIBAR, CNRS and LPS-ENS, Paris (France), BEAMISH JOHN, Dept of Physics, University of Alberta, Edmonton (Canada), ANDREW FEFFERMAN, ARIEL HAZIOT, FABIEN SOURIS, CNRS and LPS-ENS, Paris (France) — We have measured (1,2) the response of oriented $^4$He crystals to an ac-driving strain as a function of temperature, strain amplitude, frequency, and $^3$He content. The very large softening of these crystals around 0.2 K is due to the free motion of dislocations parallel to the basal planes in the absence of dissipation from collisions with thermal phonons or from the binding of $^3$He impurities. We have built a complete model for the mechanical properties of $^4$He crystals, which is in full quantitative agreement with all experimental results so that most of the properties of these dislocations are now well established. These properties are incompatible with the two scenarios that had been proposed for supersolidity in $^4$He. Dislocations have a density between $10^4$ and $10^6$ cm$^{-2}$. They move like free strings down to 20 mK, meaning that the kink energy is negligible. They have a large distribution in length and a small connectedness. $^3$He impurities bind to dislocations with an energy distributed around 0.67 K and move with them below 45 $\mu$m/s.
1- A. Haziot et al., Phys. Rev. Lett. 110, 035301 (2013), Phys. Rev. B 87, 060509(R) (2013), and Phys. Rev. B 88, 014106 (2013).
2- A. D. Fefferman et al., submitted to Phys. Rev. B, Nov. 2013.

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