Superclimbing dislocations in solid ^{4}He

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Superclimbing dislocations [1] are shown to exhibit stress induced and temperature assisted roughening proceeding as a first-order phase transition at finite temperature [2]. The transition develops at a *macroscopic* scale L_h *growing* with temperature T. For a dislocation size L smaller than L_h, speed of first sound along the superfluid core experiences a drastic suppression in a narrow temperature interval. We suggest that this feature is behind the recently observed suppression of the superflow rate [3]. Such a suppression is a consequence of the resonant-type creation of the jog-antijog pairs by the imposed chemical potential μ which induces a mechanical stress on the core. We have also found that the suppression is characterized by the *quasi-periodicity* with respect to μ and suggest that it should be searched for in the Umass-Sandwich setup [3]. For $L > L_h$, the hysteretic behavior with respect to the applied μ develops.
We also argue that contributions of a network of superclimbing dislocations, stressed by mechanical and thermal forces, to specific heat of a ^{4}He crystal are essentially independent of the dislocation density – in a full analogy to the dislocation contribution to elastic moduli [4].

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