Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Probing helium mass flow through a solid-liquid-solid double junction[1] ZHIGANG CHENG, JOHN BEAMISH, University of Alberta, ANDREW FEFFERMAN, FABIEN SOURIS, SEBASTIEN BALIBAR, Laboratoire de Physique Statistique de l'ENS — Recent experiments by Hallock and coworkers [1] observed mass transport through solid ^{4}He and suggested it was due to flow along dislocation lines. In those measurements, helium was injected and removed through Vycor "electrodes" filled with superfluid ^{4}He. Here, we report the results of a related experiment: a Vycor rod filled with superfluid ^{4}He is sandwiched between two bulk solid regions. By compressing solid ^{4}He on one side and measuring pressure changes on the other, we can detect flow through the Vycor, without necessarily having flow through the solid. In high pressure crystals we saw no flow below 1 K but in samples below 28 bar we observed flow down to the lowest temperatures (below 20 mK). The temperature dependence of this flow was very similar to that of the flow seen in previous experiments [1]: it began around 600 mK, increased as the temperature was reduced, then decreased dramatically at a temperature which depended on ^{3}He impurity concentration (around 75 mK for standard isotopic purity samples). We suggest that flow in solid ^{4}He experiments is limited by mass transfer through the solid-liquid interface at the Vycor ends.

[1] Phys. Rev. Lett. 105 145301 (2010); Phys. Rev. Lett. 113, 035302 (2014).

[1]Funding provided by NSERC Canada and by ERC (AdG 247258-SUPERSOLID)

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Date submitted: 12 Nov 2014 Electronic form version 1.4