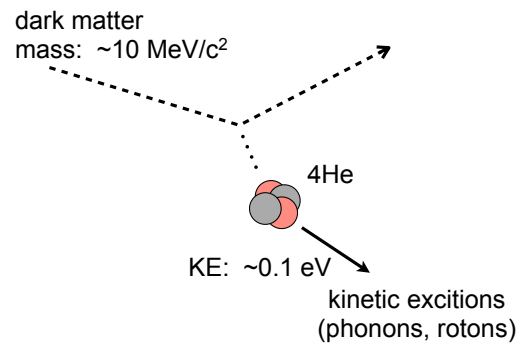


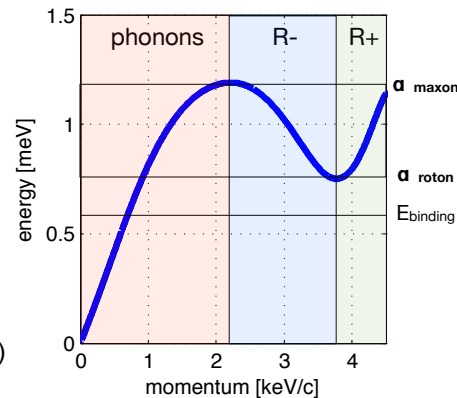
Probing light dark matter in liquid helium

The Hertel Group

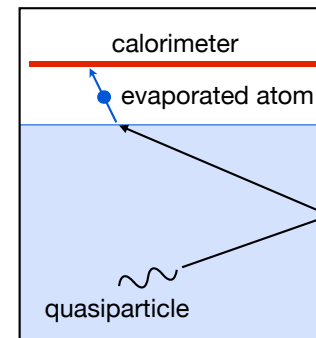
- 1) A dark matter recoil can give the (light) ^4He nucleus a significant kinetic energy.



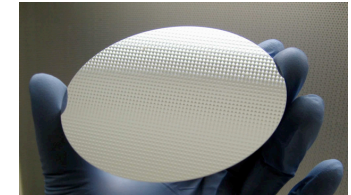
- 2) A recoiling nucleus efficiently produces long-lived kinetic excitations in the superfluid.



- 3) Kinetic excitations efficiently convert to evaporated ^4He atoms in a vacuum.



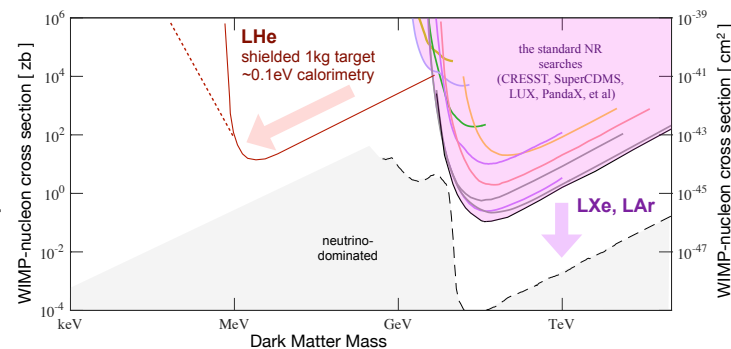
- 4) ^4He atoms in a vacuum can be sensed by a large-area calorimeter with sub-eV threshold.



current record-holder:
40 mm diameter
5 eV measured threshold

'There's plenty of room at the bottom' in dark matter mass.

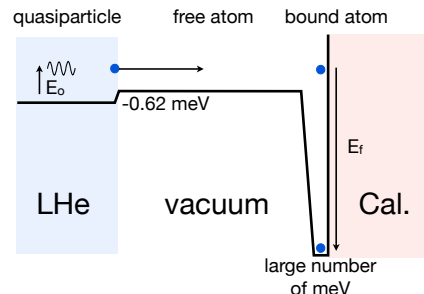
LHe may be a unique material for probing low-mass dark matter.



He sensitivity from arXiv:1604.08206v2

novel gain mechanism:

van der Waals attraction to the calorimeter

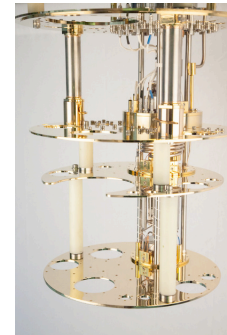


van der Waals potentials:

Typical He-solid: $\sim 10 \text{ meV}$ ($\sim 10 \times$ gain!)

He-Fluorographene: 42.9 meV ($\sim 40 \times$ gain!)

^3He - ^4He dilution fridge



new helium-project space ready April 2018

