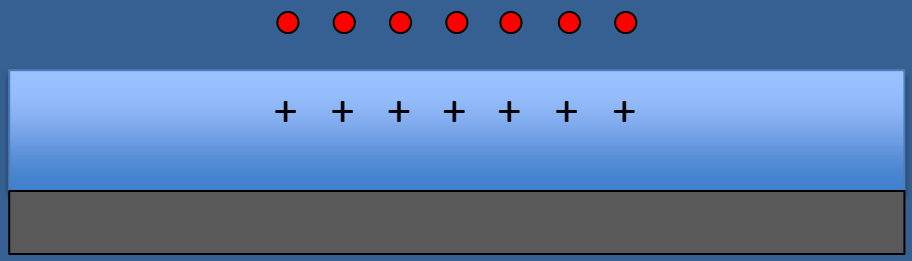
Fundamental Physics and Quantum Engineering with Electrons on Helium

Johannes Pollanen

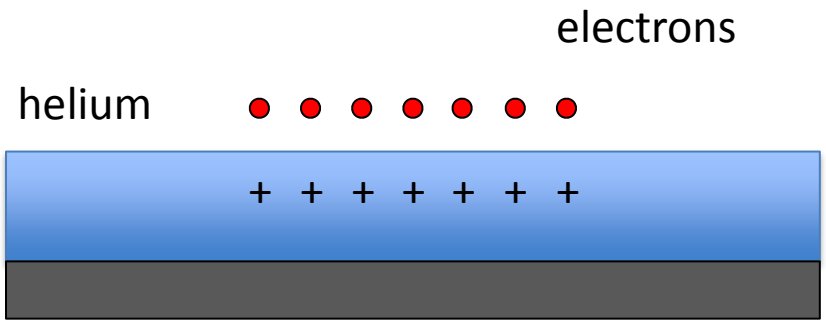


MICHIGAN STATE UNIVERSITY

IQIM
INSTITUTE FOR QUANTUM INFORMATION AND MATTER

CALIFORNIA INSTITUTE OF TECHNOLOGY
1891

eoH: Why I think they're great



- Ultra clean 2-D electrons at LT: New Physics!
- Reduced screening: Strong interactions -> New physics
- Long coherence times: Strongly interacting "disequilibrium"
- Controllable interactions: What more could an experimenter ask for!?
- Hybrid quantum systems: Many-body quantum engineering

Clean is good, but disorder is better

news & views

SUPERFLUID HELIUM

Order in disorder

Confining liquid ^{3}He in porous silica aerogel prepared with strong anisotropy stabilizes a state of axial superfluidity.

Vladimir P. Mineev

NATURE PHYSICS | LETTER

The superfluid glass phase of ^{3}He-A

J. I. A. Li, J. Pollanen, A. M. Zimmerman, C. A. Collett, W. J. Gannon & W. P. Halperin

Affiliations | Contributions | Corresponding author

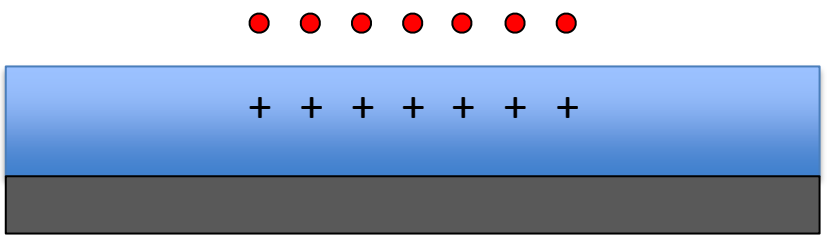
nature physics

LETTERS

PUBLISHED ONLINE: 12 FEBRUARY 2012 | DOI: 10.1038/NPHYS2220

New chiral phases of superfluid ^{3}He stabilized by anisotropic silica aerogel

J. Pollanen, J. I. A. Li, C. A. Collett, W. J. Gannon, W. P. Halperin* and J. A. Sauls

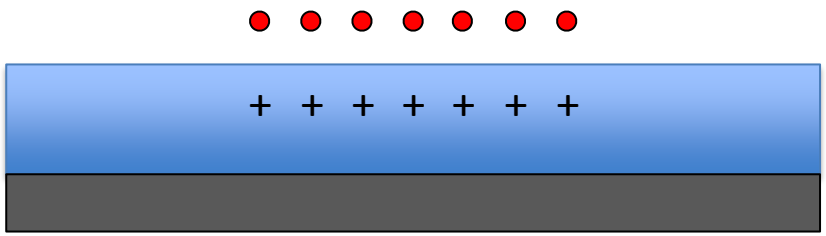


Tuning helium thickness allows for control of disorder

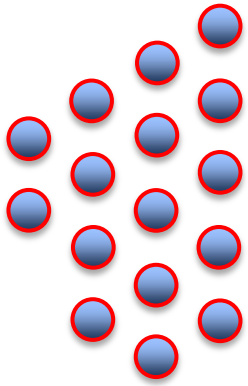
Lithographically patterned correlated disorder

Nuclear moments: e.g. addition of liquid/solid ^{3}He

Long Range Interactions and confinement



Electrons on helium have long range interactions



Strongly Correlated
e.g. Wigner solid

Tuning dimensionality means that we can study long range interactions and correlations in 2-d (plane), 1-d (wires), "0-d" (double dots)