Giant Viscosity Enhancement in a Spin-Polarized Fermi Liquid

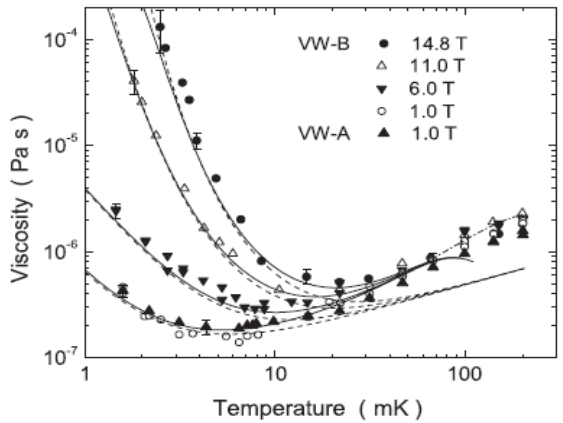
National High Magnetic Field Laboratory

High B/T Facility User Program, Microkelvin Laboratory, University of Florida

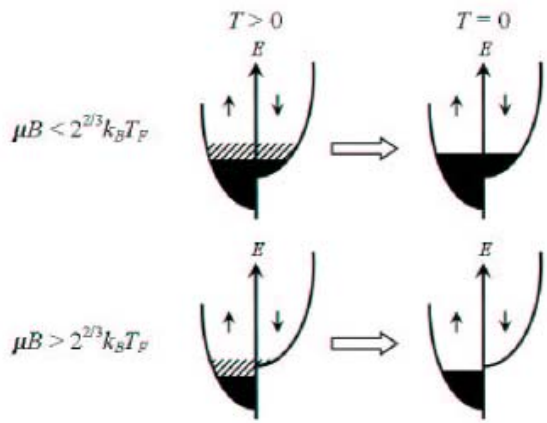
Spin polarization provides a powerful tool for investigating the quantum states of Fermi liquids, such as degenerate electrons, ultra-cold atoms, and ^{3}He-^{4}He mixtures. If the magnetic field is sufficiently high so that the Fermi energy is less than the splitting of the spin states, the polarization tends exponentially to unity as the temperature is lowered.

This effect was measured for the first time in dilute ^{3}He - ^{4}He liquid mixtures. The viscosity was measured for extremely high magnetic field/temperature conditions (B~ 15 T, T~ 2mk), for which the spin polarization attains values greater than 99%.

Akimoto, H.; Xia, J.S.; Candela, D.; Mullin, W.J.; Adams, E.D. and Sullivan, N.S., ***Phys. Rev. Lett.***, **99**, 095301 (2007)



Temperature dependence of viscosity of ^{3}He-^{4}He mixtures in high magnetic fields.



Schematic illustration of method of obtaining high spin polarizations in degenerate Fermi fluids.

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Science Quest students visit in Summer 2007. The program immerses students in science disciplines to stimulate interest in and appreciation for the range of college and career opportunities available in science. The selected students are rising 10th graders.

The High B/T facility at the University of Florida Microkelvin Laboratory hosts summer interns, including under-graduate students, teachers and trainees for several programs, including the Research Experiences for Undergraduate programs of the NHMFL and the UF physics department.

On the state–wide level, the laboratory hosts visits from high school students in Florida's Science Quest program (see left). Faculty members also give talks and demonstrations at elementary and middle schools in the area.