^{3}He films adsorbed on graphite: models for strongly correlated fermion behaviour

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The fact that helium films on graphite are atomically layered allows a wide variety of studies of strong correlations in two dimensions with density as a continuously variable tuning parameter. The ability to tune the effective adsorption potential for a ^{3}He film by pre-plating the graphite substrate provides further flexibility. Previously we have reported the observation of a divergence in the effective mass and magnetisation of a ^{3}He monolayer as its density approaches that of a $\sqrt{7} \times \sqrt{7}$ commensurate solid, corresponding to a Mott-Hubbard transition between a 2D Fermi liquid and a magnetically disordered solid[1]. More recently we have found several new phenomena in a ^{3}He bilayer adsorbed on graphite pre-plated with a bilayer of ^{4}He. Here we discuss the observation of a possible magnetic quantum critical point, tuned by the ^{3}He coverage. In the region of interest the bilayer of ^{3}He appears to comprise a layer on the verge of localisation, coupled to a fluid overlayer. The potential for Kondo-like interaction between layers in competition with RKKY exchange, against a background of a bandwidth driven 'metal-insulator' transition, make this 'simple' system a further intriguing analogue with which to explore the strongly correlated fermion problem.

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