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Puddles of Helium on graphite surfaces USHNISH RAY, NORMAN TUBMAN, University of Illinois at Urbana-Champaign — The ground state of ^3He in 2D has long been theoretically suspected to be in a non-binding gaseous state. Recent experiments with ultra low density ^3He adsorbed on Grafoil have shown, however, that below a critical density (0.6 – 0.9 nm^-2) this 2D system becomes a self bound liquid.[1] Subsequent numerical studies with an idealized graphite potential indicate that such a state is forbidden, but can possibly form on other alkali substrates.[2] A key aspect not taken into consideration in such studies are the details of the anisotropic graphite potential. Our studies with finite temperature Path-Integral Monte-Carlo and ground state Diffusion Monte-Carlo techniques that use the full anisotropic graphite potential, on the other hand, reveals an alternate picture. We find that although the effective mass induced by the graphite surface is not enough to induce a macroscopic liquid, the system can still form ultra low density liquid puddles composed of a few ^3He atoms. This picture is in agreement with experimental findings and illuminates a novel phase of Helium on graphite surfaces

[1]D. Sato, K. Naruse, T. Matsui and H. Fukuyama, Phys. Rev. Lett **109**, 235306 (2012)
[2]M. Ruggeri, S. Moroni, and M. Boninsegni, Phys. Rev. Lett. **111**, 045303 (2013)

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