Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Superfluid p-H_2 Monolayer in Carbon Nanostructures MILEN KOSTOV, Florida State University — A fluid of para-hydrogen (p-H_2) molecules is a prime candidate for potential superfluid, due to the light mass (half the mass of helium) and the existence of a compound boson ground state. In bulk p-H_2 superfluidity is not observed because, unlike helium, molecular hydrogen solidifies at a temperature (triple point T=13.8 K) significantly higher than that (T$\sim$2K) at which such phenomena as Bose Condensation and, possibly, superfluidity (SF) might occur. This is due to the fact that H_2- H_2 interaction is significantly stronger than the He-He one (more than a factor of three in the well depth). One way to attain a liquid ground state at low T is to reduce the effective attraction between the H_2 molecules. Here a novel solution to the problem is proposed, which implies that a SF monolayer p-H_2 can be achieved in a carbon slit-pore with height H $\sim$5.8 Å, where the alignment of the graphitic planes corresponds exactly to the AB stacking sequence in a pristine hexagonal graphite crystal. Our approach is based on the idea to attain a liquid ground state of p-H_2 monolayer at low T (T$\sim$2K), through a substantial renormalization of the pair interaction of p-H_2 molecules due to their interaction with the surface electrons of the carbon slit pore. In this environment, the resulting *de Boer quantum parameter* η for the adsorbed p-H_2 film lies in the vicinity of the threshold value for zero-temperature Bose liquid.

Milen Kostov
Florida State University

Date submitted: 29 Nov 2006 Electronic form version 1.4