Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

"Giant" enhancement of the upper critical field and fluctuations above the bulk Tc in superconducting ultrathin Pb nanowire arrays[1]

MINGQUAN HE, Department of Physics, William Mong Institut of Nanoscience & Technology, Hong Kong University of Science and Technology, Hong Kong — Highly interesting effects may occur in 1D superconductors with diameter smaller than the superconducting coherence length. Superconductivity in the form of a zero resistance state may be largely suppressed in 1D superconductors. Thermal activated slips in the phase of the order parameter will cause finite resistance unless at T=0 K. On the other hand, Van Hove singularities in the density of states of 1D superconductors could cause significant enhancement of the transition temperature and the low dimensionality may strongly increase the upper critical field. In this report, I will present our research on a quasi-1D superconducting system—5 nm Pb nanowire arrays embedded in the pores of mesoporous silica SBA-15. It will be demonstrated that bulk Pb (type I superconductor, Tc = 7.2 K, Hc=800 Oe) can be modified by nanostructuring to become a type II superconductor with an upper critical field exceeding 15 T and superconducting fluctuations up to $\sim$ 4 K above the bulk Tc. The material undergoes a crossover from a one-dimensional fluctuating superconductivity at high temperatures to a three-dimensional long-range-ordered superconductivity at lower temperatures [1].

[1] ACS Nano 7, 4187 (2013).

[1]This work has been supported by the Research Grant Council of Hong Kong, Grant No. 603010.

Mingquan He
Dept of Physics, William Mong Institut of Nanoscience & Technology,
Hong Kong University of Science and Technology, Hong Kong

Date submitted: 14 Nov 2013 Electronic form version 1.4