Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

**Piston-assisted proton pumping in Complex I of mitochondria membranes** LEV MOUROKH, Queens College of the City University of New York, ILAN FILONENKO, Edgemont High School — Proton-pumping mechanism of Complex I remains mysterious because its electron and proton paths are well separated and the direct Coulomb interaction seems to be negligible. The structure of this enzyme was resolved very recently and its functionality was connected the shift of the helix HL. We model the helix as a piston oscillating between the protons and electrons. We assume that positive charges are accumulated near the edges of the helix. In the oxidized state, the piston is attracted to electrons, so its distance to the proton sites increases, the energy of these sites decreases and the sites can be populated. When electrons proceed to the drain, elastic forces return the piston to the original position and the energies of populated proton sites increase, so the protons can be transferred to the positive site of the membrane. In this work, we explore a simplified model when the interaction of the piston with electrons is replaced by a periodic force. We derive quantum Heisenberg equations for the proton operators and solve them jointly with the Langevin equation for the piston position. We show that the proton pumping is possible in such structure with parameters closely resembling the real system. We also address the feasibility of using such mechanism in nanoelectronics.

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Date submitted: 15 Nov 2013 Electronic form version 1.4