Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Förster-type mechanism of the redox-driven proton pump LEV MOUROKH, Queens College of CUNY, ANATOLY SMIRNOV, FRANCO NORI, Frontier Research System, RIKEN, Japan — We propose a model to describe an electronically-driven proton pump in the *cytochrome c oxidase* (CcO). We examine the situation when the electron transport between the two sites embedded into the inner membrane of the mitochondrion occurs in parallel with the proton transfer from the protonable site that is close to the negative (inner) side of the membrane to the other protonable site located nearby the positive (outer) surface of the membrane. In addition to the conventional electron and proton tunnelings between the sites, the Coulomb interaction between electrons and protons localized on the corresponding sites leads to so-called Förster transfer, i.e. to the process when the simultaneous electron and proton tunnelings are accompanied by the resonant energy transfer between the electrons and protons. Our calculations based on reasonable parameters have demonstrated that the Förster process facilitates the proton pump at physiological temperatures. We have examined the effects of an electron voltage build-up, external temperature, and molecular electrostatics driving the electron and proton energies to the resonant conditions, and have shown that these parameters can control the proton pump operation.

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Date submitted: 20 Nov 2006 Electronic form version 1.4