Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Spontaneous Decay and Two-Qubit Entanglement in Ion-Doped Carbon Nanotubes[1] IGOR BONDAREV, NC Central University, NATALIA NOGINOVA, Norfolk State University — We study theoretically surface electromagnetic phenomena, such as spontaneous decay and entanglement of two-level atoms (qubits) close to a carbon nanotube surface[1]. The research is motivated by the progress in growth of cm-long single-walled nanotubes[2], single atom encapsulation into nanotubes[3], and the need for nanomaterials with long quantum coherence lifetimes for advanced applications in modern optoelectronics. We demonstrate the strong coupling of atomic qubits to nanotube surface virtual photon modes, which, via the virtual photon exchange, results in the two-qubit entanglement of the two spatially separated atoms (ions) encapsulated into small-diameter metallic nanotubes. We discuss how to employ Eu^{3+} ions to test our predictions as they are known to be excellent probes to study optical effects in spatially confined systems[4,5], owing to the dominant $^5D_0 -> ^7F_2$ electric dipole transition that essentially creates a two-level (qubit) system. [1] I.V.Bondarev, J. Electron. Mat. 36, 1579 (2007). [2] L.X.Zheng, et al., Nature Mat. 3, 673 (2004). [3] G.-H.Jeong, et al., Phys. Rev. B. 68, 075410 (2003). [4] S.V.Gaponenko, et al., J. Lightwave Technol. 17, 2128 (1999). [5]N.Noginova, et al., J. Appl. Phys., in print.

[1]Supported by NSF via grant No ECS-0631347.

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Date submitted: 02 Dec 2007 Electronic form version 1.4