Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Nanoscale neuroelectronic interface based on open-ended nanocoax arrays JEFFREY R. NAUGHTON, BINOD RIZAL, MICHAEL J. BURNS, JEE YEOM, SHANNON HEYSE, MICHELLE ARCHIBALD, STEPHEN SHEPARD, GREGORY MCMAHON, THOMAS C. CHILES, MICHAEL J. NAUGHTON, Boston College — We describe the development of a nanoscale neuroelectronic array with submicron pixelation for recording and stimulation with high spatial resolution. The device is composed of an array of nanoscale coaxial electrodes, either network- or individually-configured. As a neuroelectronic interface, it will employ noninvasive real-time capacitive coupling to the plasma membrane with potential for extracellular recording of intra- and interneural synaptic activity, with one target being precision measurement of electrical signals associated with induced and spontaneous synapse firing in pre- and post-synaptic somata. Subarrays or even individual pixels can also be actuated for precisely-localized stimulation. We report initial results from measurements using the rat adrenal pheochromocytoma PC12 cell line, which terminally differentiates in response to nerve growth factor, as well as SH-SY5Y neuroblastoma cells in response to retinoic acid, characterizing the basic performance of the fabricated device.

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Date submitted: 11 Nov 2011 Electronic form version 1.4