Abstract for an Invited Paper
for the MAR11 Meeting of
The American Physical Society

Nanogenerators and Piezotronics
ZHONG LIN WANG, Georgia Institute of Technology

Developing wireless nanodevices and nanosystems is of critical importance for sensing, medical science, environmental/infrastructure monitoring, defense technology and even personal electronics. It is highly desirable for wireless devices to be self-powered without using battery. This is a new initiative in today’s energy research for mico/nano-systems in searching for sustainable self-sufficient power sources [1]. We have invented an innovative approach for converting nano-scale mechanical energy into electric energy by piezoelectric zinc oxide nanowire arrays [2]. As today, a gentle straining can output 1-3 V from an integrated nanogenerator, using which a self-powered nanosensor has been demonstrated. A commercial LED has been lid up [3-5]. Due to the polarization of ions in a crystal that has non-central symmetry, a piezoelectric potential (piezopotential) is created in the crystal by applying a stress. The effect of piezopotential to the transport behavior of charge carriers is significant due to their multiple functionalities of piezoelectricity, semiconductor and photon excitation. Electronics fabricated by using inner-crystal piezopotential as a “gate” voltage to tune/control the charge transport behavior is named piezotronics [6,7]. Piezo-phototronic effect is a result of three-way coupling among piezoelectricity, photonic excitation and semiconductor transport, which allows tuning and controlling of electro-optical processes by strain induced piezopotential [8].