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Growth and Optical Properties of Site-controlled GaN/AlGaN Nanowire Quantum Dots

Prof. Yasuhiko Arakawa

时间：9月6日（星期五）上午 9:30—10:30

地点：北京大学物理大楼中212教室

About speaker: Yasuhiko Arakawa was born in Aichi Prefecture, Japan in 1952. He received his BE, ME, and PhD degree in Electronics and Electrical Engineering from the University of Tokyo, Japan in 1975, 1977 and 1980, respectively. In 1980, he joined the University of Tokyo as an Assistant Professor and became a full Professor in 1993. He has been a member of Science Council of Japan since 2009. He has contributed pioneering research on quantum dots and nano-photonic devices, including the proposal of the quantum dots and their application to lasers, the discovery of cavity polariton effect in semiconductors, single photon emitters operating at telecom wavelengths, the demonstration of single artificial atom lasers, and the theoretical limit of conversion efficiency of quantum dot solar cells. He is a Vice President of International Commission of Optics (ICO) and Editor in Chief in Asia Area for New Journal of Physics (NJP). He is Fellows of IEEE, OSA, JSAP, and IEICE. He has received several major awards including Leo Esaki Award (2004), IEEE/LEOS William Streifer Award (2004), Fujiwara Award (2007), Prime Minister Award (2007), Medal with Purple Ribbon (2009), IEEE David Sarnoff Award (2009), C&C Award (2010), Heinrich Welker Award (2011), OSA Nick Holonyak Jr. Award (2011), and JSAP Isamu Akasaki Award (2012)

Abstract: To date, the majority of quantum dot coherent control experiments have been performed on QDs formed in the III-As semiconductor system, with which a 2-qubit CNOT logic gate has also been realized using exciton and biexciton states. However, there have been no reports on the successful coherent optical manipulation of III-Nitride QDs, which emit in the UV to visible regions. The III-Nitride system is promising as it can sustain room-temperature stable excitons in single GaN QDs; a property which enabled the realization of a single photon emitter operating at 200K.Recently, in order to control the site of such QDs, we have developed the selective area growth of nanowires containing single QDs by MOCVD. Our high-quality GaN QDs exhibit a very large biexciton binding-energy, fine structure splitting, and a strong phonon interaction. Moreover, the presence of the excited states in single GaN QDs was evidenced by means of photoluminescence excitation (PLE) measurements.In this presentation, we discuss recent progress in the growth and optical properties of site-controlled GaN quantum dots in GaN/AlGaN nanowires, including the experimentalobservation of excited state Rabi rotation, where damped oscillation has been observed in the power dependent spectra of the quantum dot ground state upon resonant pumping of an excited stat.

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