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Whispering-gallery microresonators for functional devices

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Light-matter interactions are the fundamental basis for many phenomena and processes in optical devices. In this talk ultra-high-quality (Q) optical Whispering-Gallery-Mode (WGM) microresonators, in which light-matter interactions are significantly enhanced due to their superior capability to trap light field in a highly confined volume with low loss will be introduced. There are various applications of ultra-high-Q WGM microresonators. In particular, the development of a laser assisted processing method to create optical microresonators with Q-factors in excess of 100 million will be discussed. Next, the adaptation of this process to create active devices based on a sol-gel oxide delivery process will be described. This new step enables synthesis of high quality oxide films to achieve ultra-high-Q resonators on silicon wafers. It is also a convenient and efficient method to incorporate optical gain dopants into the oxide layer deposited on a silicon wafer, providing a route to achieve arrays of microlasers on silicon wafer with emission spectral windows from visible to infrared. As an illustration of this method, micro lasers on a silicon chip by doping high-Q micro resonators with rare-earth ions will be described. One of the recent discoveries of using ultra-high-Q microresonators and micro lasers for ultra-sensitive self-referencing detection and sizing of single virion, dielectric and metallic nanoparticles will also be presented. Finally, the exploration of fundamental physics, such as parity-time symmetry and light-matter interactions, in high-quality WGM resonators for achieving a new generation of optical systems enabling on-chip manipulation and control of light propagation will be discussed.

Biography

Lan Yang is an Associate Professor in the Preston M. Green Department of Electrical and Systems Engineering at Washington University, St. Louis, MO. She received PhD in Applied Physics from Caltech in 2005. Her current research interests include novel photonic materials and nano/micro photonic devices for energy, biomedical research, and optical communication. She received NSF CAREER Award in 2010 for her work on single particle detection and sizing using an on-chip optical resonator for the first time. She is also the recipient of the 2010 Presidential Early Career Award for Scientists and Engineers (PECASE).

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