Prof. Ray Chen [3] of Texas ECE demonstrated a fully automatic silicon nanomembrane-based early cancer detection system at the SPIE Photonics West Conference this month in San Francisco. The system is a result of research work that resulted in a myriad of sensing devices for LIDAR, low-concentration biomarker detection, heavy metal detection, air-and water-pollution sensing, 40 Gbit/sec EO modulator, and wide band RF sensors. The nanotechnology is based on photonic crystal waveguide (PCW) nanostructures and has a feature size down to 50 nm. When properly designed, PCWs can trap a photon using bandgap-engineered point and line defects to form waveguides and waveguide cavities within which a myriad of biomarkers can be detected with unprecedented sensitivity. The devices can manipulate the defect nano-structure such that speed of light can be drastically reduced which provides a much longer interaction between photons and the analytes. Due to the slow light effect and highly mode overlapped structure, the device is more sensitive than any existing devices in the market with a much smaller form factor. A variety of automated handheld and desktop devices using the technology are currently in development.
Above SEM pictures are two types of cavities shown for early cancer detection. Both are fabricated in the nanofabrication facility at the Microelectronics Research Center.
The research was developed using funding totaling more than $10 million funded by the Air Force Office of Scientific Research (AFOSR)/Air Force Research Laboratory (AFRL), the US Army, the US Navy, Department of Energy, the National Institutes of Health (NIH), National Institute of Standards and Technology (NIST), National Science Foundation (NSF), and Environmental Protection Agency (EPA).

The nanofabrication of all silicon nanomembrane devices are developed in the National Science Foundation National Nanotechnology Infrastructure Network (NNIN) facility at the Microelectronics Research Center at The University of Texas at Austin. NNIN is an integrated networked partnership of user facilities, supported by the National Science Foundation, serving the needs of nanoscale science, engineering and technology.

SPIE Photonics West is the world's largest biomedical, optics, and laser conference.
Dr. Ray Chen is the Keys and Joan Curry/Cullen Trust Endowed Chair at The University of Texas at Austin. He is the director of the Nanophotonics and Optical Interconnects Research Lab as well as the director of the AFOSR MURI Center for Power-Efficient Silicon Nanophotonics for Optical Computing and Interconnects. Chen’s group at UT Austin has reported its research findings in more than 930 publications, including over 100 invited papers and 74 patents. He has chaired or been a program-committee member for more than 120 domestic and international conferences organized by IEEE, SPIE (The International Society of Optical Engineering), OSA, and PSC. He has served as an editor, co-editor or coauthor for over twenty books. Chen has also served as a consultant for various federal agencies and private companies and delivered numerous invited talks to professional societies. Chen is a Fellow of IEEE, OSA, and SPIE. Chen’s group has graduated 50 PhD students and many of them are faculty members in US Research Universities.