IOWA STATE UNIVERSITY
MECHANICAL ENGINEERING GRADUATE STUDENT ORGANISATION

Monday, December 3rd, 12:00-1:00 p.m.
2004 Black Engineering

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Abstract:

A micro/submicron particle induced near-field effect can focus the incident laser beam to a small region of tens of nanometers (nm). This phenomenon has been widely used in surface nanostructuring, particle-assisted surface nanostructure imaging under normal optical microscope, and surface enhanced Raman spectroscopy. Despite various research efforts in the literature on the near-field focusing effect, no experiment has been reported on characterizing the temperature field induced by the extremely focused laser beam. In this work, we report on novel and pioneering experiment to measure the temperature of a region less than 100 nm size induced by near-field focusing. Raman spectroscopy is used for temperature measurement by observing the Raman frequency shift. Great measures have been taken to rule out the tiny Raman frequency drift in the experiment to ensure high-accuracy temperature measurement with an accuracy around 0.1 K. The effects of particle size and laser beam energy are fully investigated. Most importantly, for the first time we demonstrate that even though the laser beam is about mm size, we could achieve a resolution about 50 nm or smaller in terms of measuring the temperature distribution in space. This represents the first experimental measurement of the near-field focused laser beam distribution in space and its induced thermal field.

Bio:
Xiaoduan Tang received his bachelor's and master's degrees in Thermal Engineering from Xi'an Jiaotong University, China. Currently, he is working on his Ph.D. in Mechanical Engineering at Iowa State University. His research interests include nanoscale thermal probing, Raman thermometry and heat transfer in near-field optics.

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This seminar counts towards the ME 600 seminar requirement for Mechanical Engineering graduate students.

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