

# Physics Colloquium

Michigan Technological University

Thursday, February 13, 2014

at 4:00 pm

Room 139 Fisher Hall



## Optical Probing Techniques for Integrated Circuits: Improving a Billion Transistors, One at a Time

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**Abstract:** This lecture will present optical probing techniques that are used to improve the design and yield of integrated circuits (IC's). Modern IC's can contain over a billion transistors; however, it only takes one critical flaw to ruin the entire circuit—A search for these flaws is the proverbial “needle in the haystack”, or perhaps more appropriately a “needle in the needle stack”. The pursuit is exasperated by many layers of metal interconnect blocking access to the transistors and feature sizes that continually scale down (11-18 nm circuits are expected soon). Hence, access to the transistors must be made through the Si substrate, the so-called “backside” of the IC. This requires infrared wavelengths ( $\lambda \sim 1 \mu\text{m}$ ) that severely limit the achievable optical resolution. In this lecture, methods to address these issues will be presented: After reviewing the optical properties of silicon, efforts to improve resolution through the “backside” using Solid Immersion Lens (SIL) technology will be discussed, and then finally optical techniques will be described that are used to isolate circuit faults. These high impact techniques help to improve the circuit design and/or fab yields: one transistor at a time.

**Bio:** Dr. Michael Bruce received a Ph.D. degree in Physics from The University of Texas at Austin in the area of Laser, Atomic and Molecular Physics. For many years he was a Senior Member of the Technical Staff at Advanced Micro Devices, Inc. (AMD) in Austin, Texas. Today he is working as an independent consultant at Stanford Research International (SRI) in Stanford, California and AMD in Austin. He serves as an Editor of *Electronic Device Failure Analysis* magazine. Dr. Bruce has chaired numerous symposia and forums dedicated to semiconductor processing and analysis. He is author or co-author on 74 patents and 32 scientific and technical publications.