Abstract:
The talk will describe a range of new and challenging inverse problems in ultra-fast imaging.

Can we look around corners beyond the line of sight? Our goal is to exploit the finite speed of light to improve image capture and scene understanding. New theoretical analysis coupled with emerging ultra-high-speed imaging techniques can lead to a new source of computational visual perception. We are developing the theoretical foundation for sensing and reasoning using Femto-photography and transient light transport, and experimenting with scenarios in which transient reasoning exposes scene properties that are beyond the reach of traditional computational imaging.

The key idea is to time-resolve the multiple diffuse bounces of light. In addition to the ability to image hidden objects, the analysis also allows us to recover reflectance properties and sub-surface scattering. Visualization of the propagation of light provides a fascinating intuitive insight into the complex light transport.

We are making the existing datasets from our unique ultra-fast device available and invite researchers to send proposals for new capture configurations or applications. (Joint work with a large team, please see http://raskar.info/femto and http://raskar.info/trillionfps)

The ever increasing resolution of new LCDs and CMOS sensors in cellphones provides a new opportunity to build imaging and diagnostic platforms. These platforms will soon match the performance of today's high end scientific instruments. NETRA is a cell phone based solution for estimating refractive errors in the human eye. The NETRA autorefractor-like system uses the dual of a Shack-Hartmann sensor, and replaces the laser with simple user interaction. (Joint work with Pamplona, Mohan and Oliviera http://eyenetra.com). CATRA generates cataract Maps with snap-on eyepiece for cell phones. CATRA uses a forward scattering technique that dramatically simplifies the slit-lamp exam that relies on a backward scattering analysis. (Joint work with Pamplona, Passos, Zizka, Oliveira, Lawson, Clua, http://eyecatra.com)

Speaker Short Bio:
Ramesh Raskar is an Associate Professor at MIT Media Lab and heads the Lab’s Camera Culture research group. He joined MIT from Mitsubishi Electric Research Laboratories (MERL) in 2008.

His research interests span the fields of computational light transport, computational photography, inverse problems in imaging and human-computer interaction. Recent projects and inventions include transient imaging to look around a corner, a next generation CAT-Scan machine, imperceptible markers for motion capture (Prakash), long distance barcodes (Bokode), touch+hover 3D interaction displays (BiDi screen), low-cost eye care devices (Netra,Catra), new theoretical models to augment light fields (ALF) to represent wave phenomena and algebraic rank constraints for 3D displays(HR3D).

He is a recipient of TR100 award from Technology Review, 2004, Global Indus Technovator Award, top 20 Indian technology innovators worldwide, 2003, Alfred P. Sloan Research Fellowship award, 2009 and Darpa Young Faculty award, 2010. Other awards include Marr Prize honorable mention 2009, LAUNCH Health Innovation Award, presented by NASA, USAID, US State Dept and NIKE, 2010, Vodafone Wireless Innovation Award (first place), 2011. He holds over 40 US patents and has received four Mitsubishi Electric Invention Awards. He is currently co-authoring a book on Computational Photography. [Personal webpage http://raskar.info]