

**You are invited to an IEEE Meeting on
Wednesday, Nov 30, 2011**



Title: **Application of Time-reversal Methods to Communication
in Hostile Environments**

Speaker: **Dave Chambers**, Lawrence Livermore National Laboratory
Date: Wednesday, November 30, 2011
Time: Presentation from 12:30 PM – 2:00 PM
Cost: No charge. [US Citizenship is necessary for entry for this event; future meetings may be able to relax this requirement.](#)
Place: Livermore Valley Open Campus – Lawrence Livermore Nat'l Laboratory, Greenville Rd, Livermore
[Building 6475 is located 100m south of the Eastgate Ave entrance on Greenville Rd. Signage includes the HPC Innovation Center and the UNCLE Credit Union.](#)
RSVP: **Please make reservation** by emailing Ron Kane
email: kane@ieee.org

Meeting Description:

The application of time-reversal (TR) methods to the problem of communication in a highly reverberant environment is a new area motivated by advances in TR theory. The fundamental concept involves time-reversing the impulse response or Green's function characterizing the uncertain communications channel to mitigate dispersion and multi-path effects. This talk presents four basic approaches to implementing TR for both single antenna and array communication systems. Experiments with an acoustic communication system placed in a highly reverberant room show TR methods can significantly reduce the effects of multipath and noise. The performance is compared with the more conventional linear equalizer (inverse filter) which is the optimal solution when all the reverberations are included. Not only do TR methods perform well in hostile environments but they can also be implemented with a "1-bit" analog-to-digital (A/D) converter design. These perform quite well compared to the full 16 bit full dynamic range implementation. In addition, experiments with an ultrasonic system show that TR methods can exploit multipath to create a secure communication channel with a receiver at a particular location. Finally, an implementation of TR for ultra-wideband, carrier-less communications is described.

About the Speaker:

Originally from southeast Kansas, David Chambers did his undergraduate study at Washington University in St. Louis from 1976 to 1982, earning Bachelor degrees in both physics and mechanical engineering, and a Master's degree in Physics. He continued his graduate study at University of Illinois at Urbana-Champaign, earning a PhD in Theoretical and Applied Mechanics in 1987 for work on statistical representations of coherent structures in turbulent flow. Afterward he took a position as Physicist at Lawrence Livermore National Laboratory working on propagation of high energy laser beams through the atmosphere and radar imaging of the ocean surface. Moving from Lasers to Electrical Engineering he worked on acoustical array processing, design of broadband acoustic beams, acoustical tomography, and imaging. His recent interests include applications of time reversal symmetry to target characterization and communications for both acoustic and radar applications. He has published papers in the IEEE Transactions for Antennas and Propagation, Journal of the Acoustical Society of America, Physical Review, and others. He is a Senior Member of IEEE, Fellow of the Acoustical Society of America, and a member of the American Physical Society and Society of Industrial and Applied Mathematics.