



SAN FRANCISCO BAY AREA  
NANOTECHNOLOGY COUNCIL

**Feb 2009 Seminar**

**Event co-sponsored with IEEE CPMT Society**

**Subject: The Basic Electronic Components: Finding the Missing Memristor**

**Speaker: Dr. R. Stanley Williams**  
HP Senior Fellow  
Director of the Information and Quantum Systems Laboratory

**Date:** Wednesday, February 11, 2009

**Time:** Seated dinner served at 6:30 PM (\$25 if reserved by Feb. 2; \$30 if reserved by Feb. 6, \$40 after & at door; vegetarian available). Presentation (no cost) at 7:30 PM

**NEW LOCATION FOR THIS EVENT ONLY: Biltmore Hotel**

2151 Laurelwood Rd (Fwy 101 at Montague Expressway), Santa Clara

<http://www.cpmt.org/scv/meetings/biltmoremap.jpg>

**Please RSVP at:** <http://www.doubleknot.com/Registration/CalendarDetail.asp?ActivityKey=503866&OrgKey=861>

**Talk Abstract:**

The existence of a fourth passive circuit element was proposed by Prof. Leon Chua of UC Berkeley in 1971 from fundamental symmetry arguments unifying resistance, inductance and capacitance equations. Although he showed that such a 'memristor' had many interesting and useful circuit properties, until this year no one had presented a physical model nor material example of such an element. In fact, memristance arises naturally in systems for which electronic and atomic transport are coupled under an external bias voltage. A simple analytical model shows that the nonlinear term that determines the magnitude of memristance is inversely proportional to the square of the thickness of the active device, and demonstrates that such nonlinear behavior is much more important and prevalent for electronic devices with nanoscale dimensions. These results serve as the foundation for understanding a wide range of hysteretic current-voltage behavior observed over the past 50 years in many electronic devices that involve the motion of atoms, vacancies or molecular components. We have built nanoscale titanium dioxide memristors in our laboratory and have demonstrated many of their electrical properties and potential uses, including new forms of logic circuits. These devices can rather easily be integrated into electronic circuits using conventional materials available in standard CMOS fabrication facilities.

**Speaker Biography:**

R. Stanley Williams is an HP Senior Fellow at Hewlett-Packard Laboratories and Director of the Information and Quantum Systems Laboratory (IQSL), which currently has over 80 scientists and engineers working in areas of fundamental physical sciences and engineering. He was a Member of Technical Staff at AT&T Bell Labs from 1978-80 and a faculty member (Assistant, Associate and Full Professor) of the Chemistry Department at UCLA from 1980-1995. He joined HP Labs in 1995 to found the Quantum Science Research group, which focused primarily on fundamental research at the nanometer scale. He has been awarded 77 US patents with more than forty pending, he has published over 300 papers in reviewed scientific journals and he has written several general articles for technical, business and popular publications. He received a B.A. degree in Chemical Physics in 1974 from Rice University and his Ph.D. in Physical Chemistry from U. C. Berkeley in 1978.