

**UNIVERSITY OF TEXAS AT DALLAS - DEPARTMENT OF PHYSICS**  
**PHYSICS COLLOQUIUM**

<http://www.utdallas.edu/dept/physics/colloquia1.htm>

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Wednesday, March 2, 2005; 4:00-5:00 PM  
in Kusch Auditorium, FN 2.102

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**Atomic and Molecular Scale Electronic Transport**

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There has been recent interest in atomic and molecular scale electronic transport, and the physics underlying it remains an exciting and open area of active research. To understand the mechanism, we need a method to directly measure the conductance of a single molecule wired to two electrodes so that it allows one to study charge transport, a phenomenon that is critical in many chemical and biological processes, on a single molecule basis. It also allows one to read the chemical and biological information of the molecule electronically, which opens the door to chemical sensor applications based on electrical measurement of individually wired molecules. To reliably measure the conductance, one must provide a reproducible electronic coupling between the molecule and the probing electrodes. One must also find a signature to identify that the measured conductance is due to not only the sample molecules but also a single sample molecule. Finally, for biologically relevant molecules, it is highly desired to carry out the measurement in aqueous solutions in order to preserve the native conformation of the molecule. We have developed a method to attach a single molecule to two electrodes via covalent bonds, which allows us to reliably measure single molecule conductance of many systems, including peptides and DNA in aqueous solutions. By simultaneously measuring the conductance and the force required to break a molecule from contacting the electrodes, we can identify how many molecules are involved in the measurements and if the molecules are indeed covalently bonded to two electrodes. We have studied the dependence of the conductance on the sequence, length as well as specific bindings of the molecules with other species. The electronic transport in atomic wires will also be discussed.