



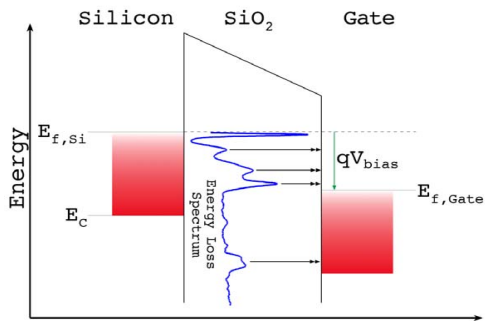
# Tunneling Spectroscopy of the Silicon-Oxide-Semiconductor System

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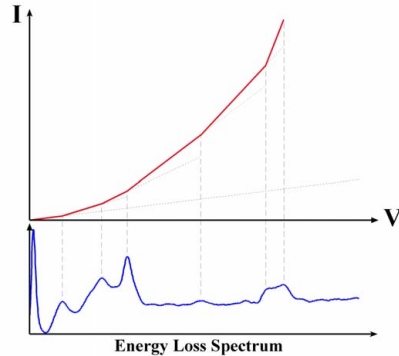
Center for Microelectronic Materials and Structures. Dept. of Electrical Eng'g Yale Univ.



## Principle of Tunneling Spectroscopy

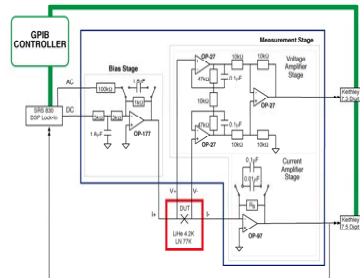


Semiconductor-Insulator Band to Band Tunneling



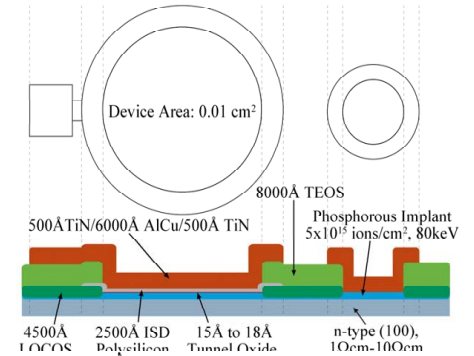
Tunneling Current vs Voltage  
(Energy Distribution of Defects vs Voltage  
Revealed by Second Derivative of I wrt V .)

## Experimental Setup and Electronics

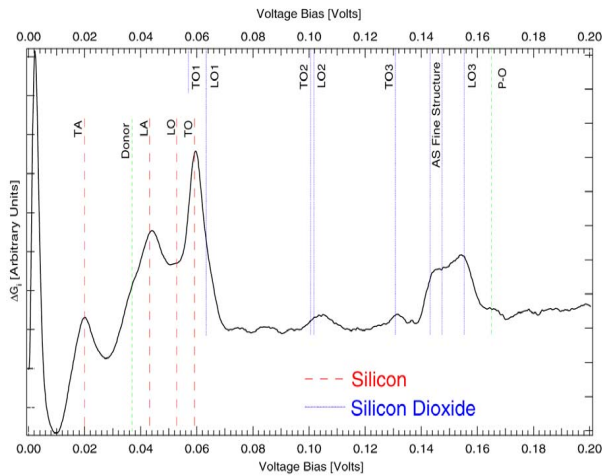


Electronic Circuits for analysis

## Device Cross-section



Device Cross Section - Showing THIN Insulator



Second Derivative Showing Vibrational Modes of Silicon and Insulator

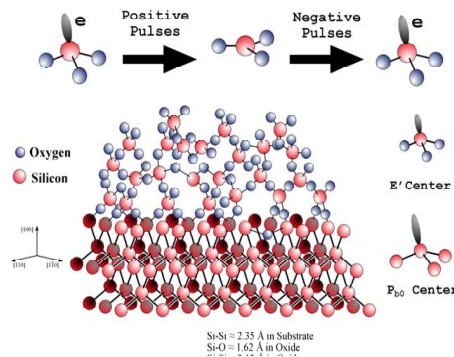
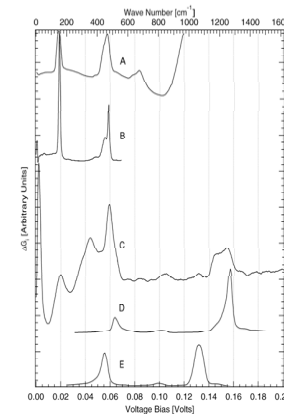
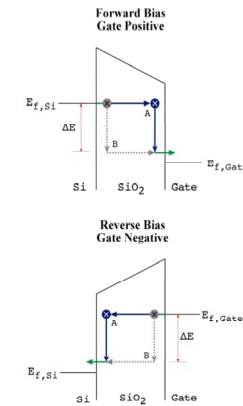


Diagram of Si-SiO<sub>2</sub> Interface, Showing Vibration Modes



Comparison of Data with Older Methods



Which Side of Junction "Vibrates"?