Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Tunneling in Al/Al2O3/Al junctions and its direct link with energy gap and tunneling time across the barrier. EDGAR PATINO , NEELIMA KELKAR, Universidad de los Andes — Quantum tunneling has been widely used in order to investigate the density of states of the materials across the barrier and magnetoresistance in magnetic tunnel junctions (MTJs). In spite of the possible applications there is no clear understanding of the barrier parameters as a function of temperature. Measurements of current-voltage (I-V) characteristics of a high quality $Al/Al_2O_3/Al$ junction at temperatures ranging from 3.5 K to 300 K have been used to extract the barrier properties. Fitting results using Simmons model led to a constant value of barrier width $s{\sim}20.8$ Å and a continuous increase in the barrier height with decreasing temperature. The latter is used to determine the energy band gap temperature dependence and average phonon frequency $\omega = 2.05 \times 10^{13}$ sec^{-1} in Al2O3. Finally from the experimentally extracted barrier height and width parameters we calculate the tunneling time for a solid state tunnel junction. The order of magnitude of this time corresponds to the one obtained in sophisticated experiments.The barrier parameters are used to extract the temperature dependent dwell times in tunneling ($\tau_D = 3.6 \times 10^{-16}$ sec at mid-barrier energies) and locate resonances above the barrier.

Edgar Patino
Universidad de los Andes

Date submitted: 11 Jan 2016 Electronic form version 1.4