# MIT 6.772 / SMA 5.111 LECTURE #5



20 FEB. 2003

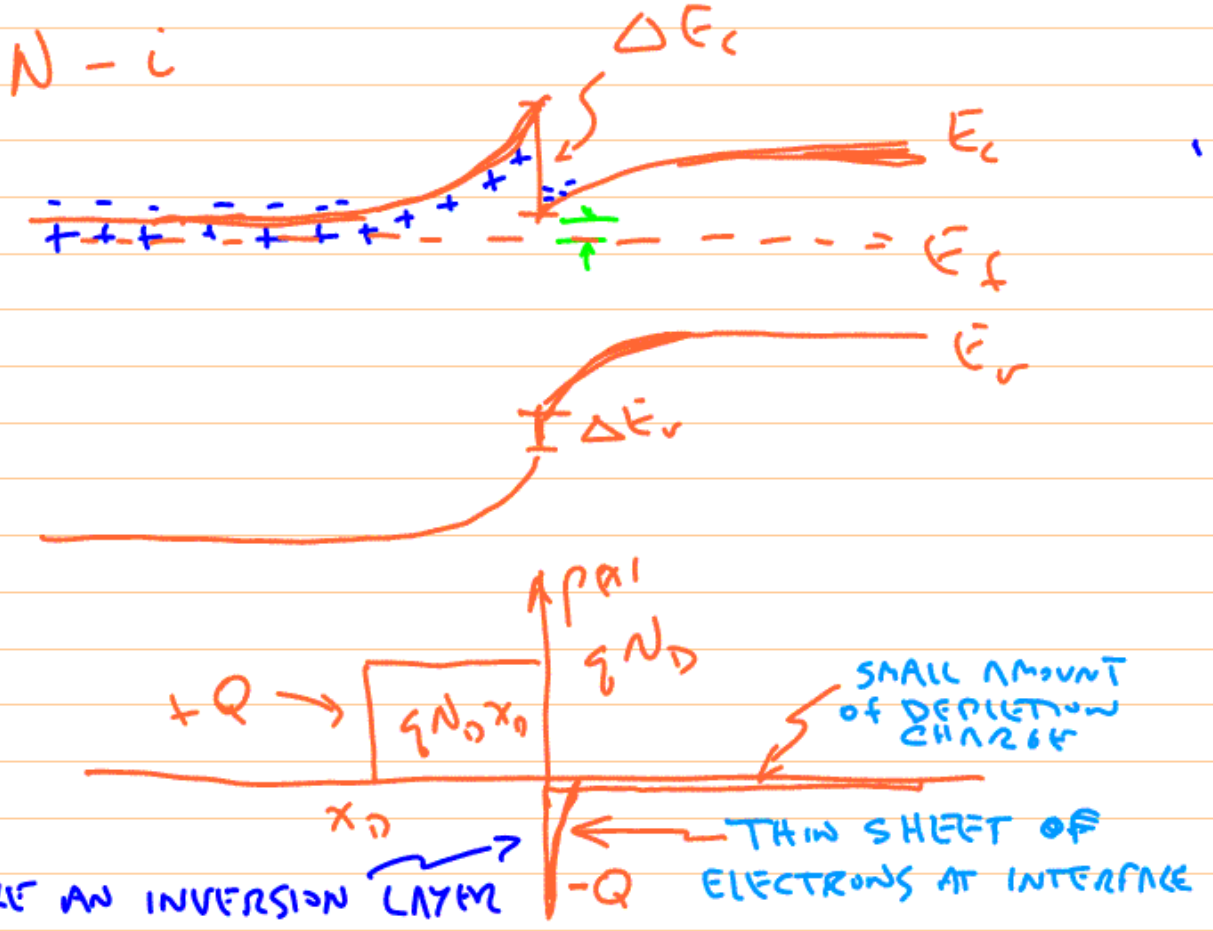
Note Title 2/10/2003

## I. COMMENTS ON QUASI-FERMI LEVELS AND BAND-EDGE GRADIENTS

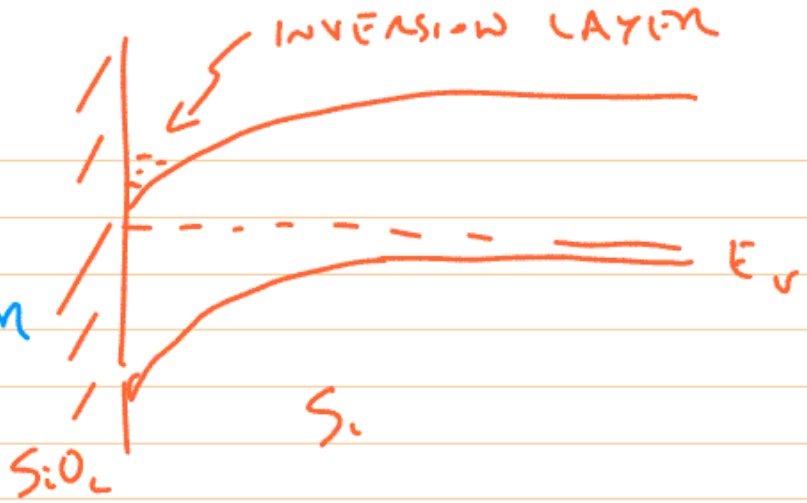
## II. 2-DEG's AND CONDUCTION PARALLEL TO HETEROINTERFACES

## III. QUANTUM HETEROSTRUCTURES (part 1)

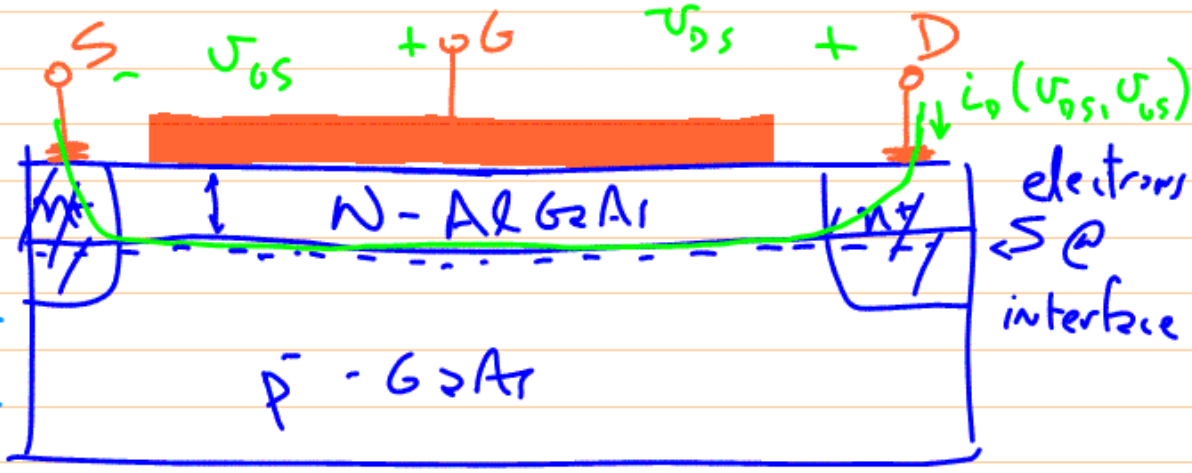
NOTE: RECITATION NEXT MON PM (TUES AM) BOSTON (SINGAPORE)
IS FROM 8:30-9:30 PM (9:30-10:30 AM)

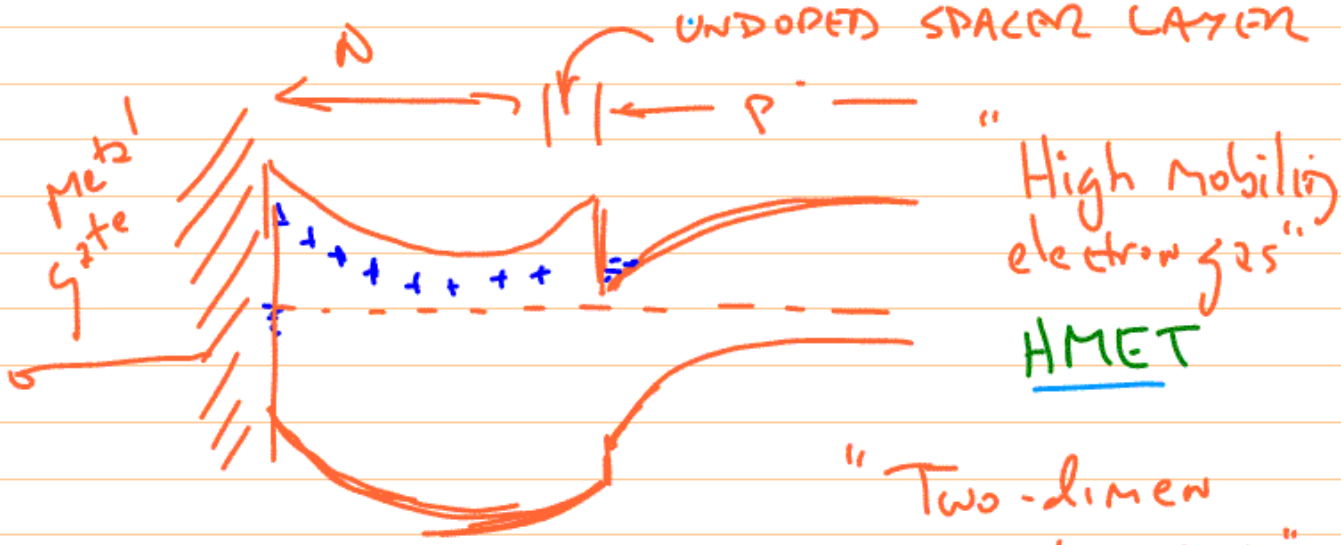


* THIS THIN SHEET OF ELECTRONS IS JUST LIKE THE INVERSION LAYER IN AN MOS STRUCTURE.




AN FET BASED ON THE INTERFACE CARRIER SHEET:




* THESE ARE THE TOPIC OF LEC. 12

NOTE: THE BAND BENDING CAUSED BY THE SURFACE DEPLETION DUE TO SURFACE STATE PINNING, AND CAUSED BY THE $\Delta E_c$ AT THE HETERO INTERFACE COMBINE TO FULLY DEPLETE THE N-LAYER IF THE N-LAYER IS THIN ENOUGH AND NOT DOPED TOO HEAVILY. WHEN THIS HAPPENS THE ONLY PATH FOR ELECTRONS BETWEEN THE S AND D IS VIA THE INTERFACE CHARGE SHEET.

WE WILL STUDY FET'S BASED ON THIS IN LECTURE 12.

THE UNDOPED WIDE BANDGAP SPACER LAYER SHIELDS THE CARRIERS IN THE CHARGE SHEET FROM THE IONIZED DONORS, GREATLY REDUCING CARRIER SCATTERING AND INCREASING THEIR MOBILITY. IT ALSO LEADS TO A BIG REDUCTION IN DEVICE NOISE, AS WE SHALL DISCUSS IN LECTURE 12.

FOR HOLES AND REJECT