

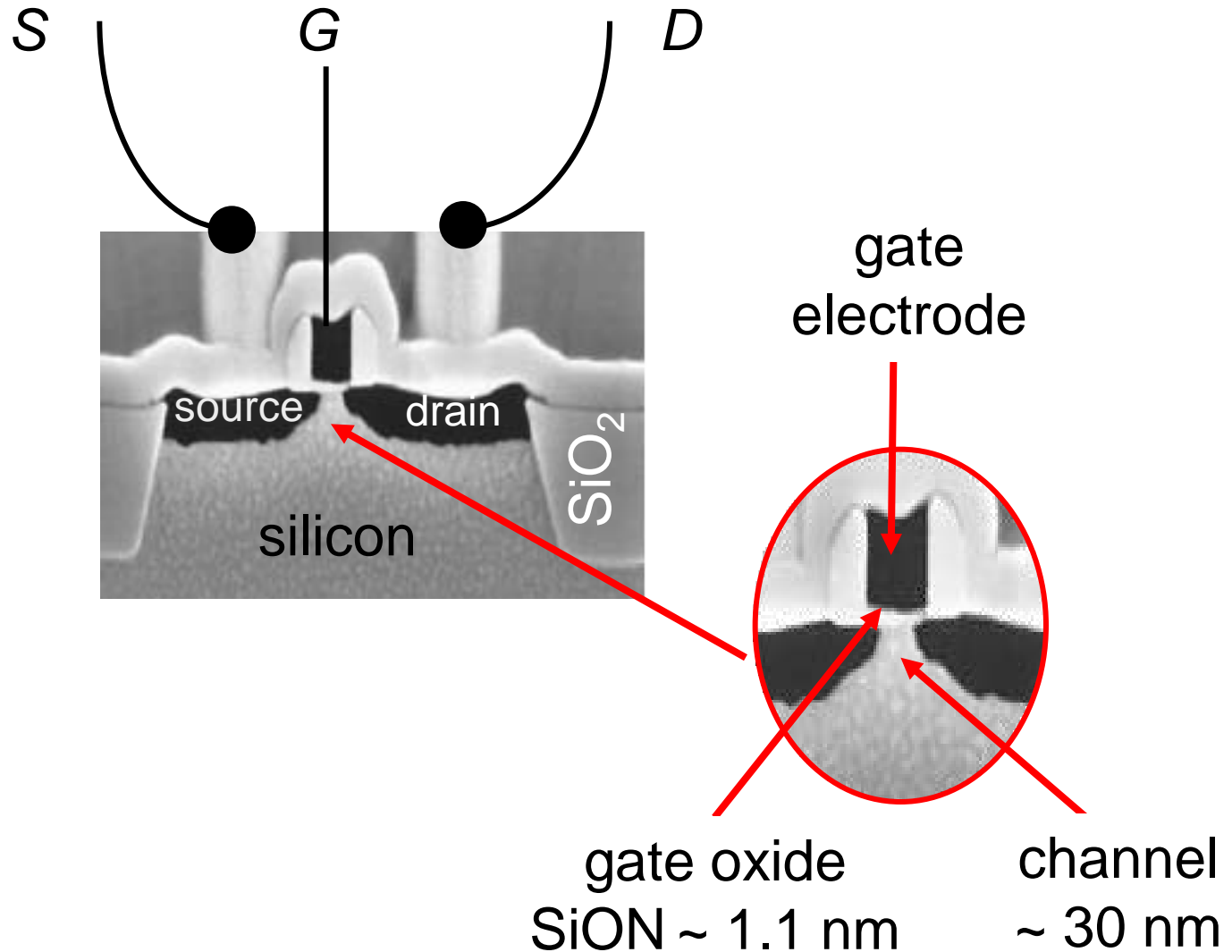
IEEE Electron Device Society Distinguished Lecture

an introduction to the

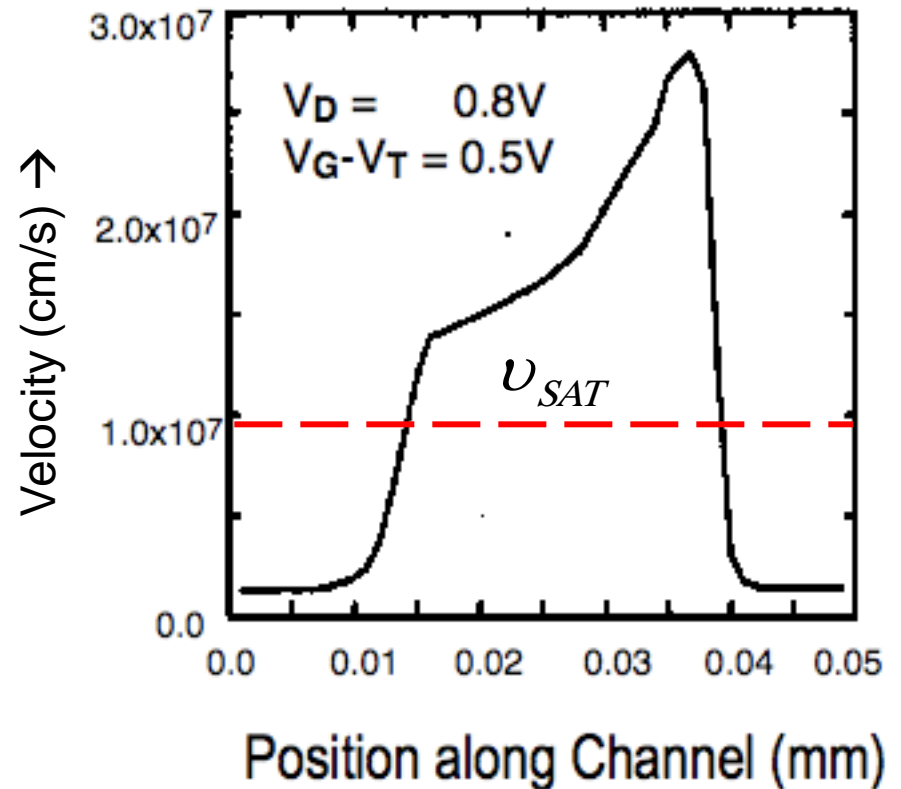
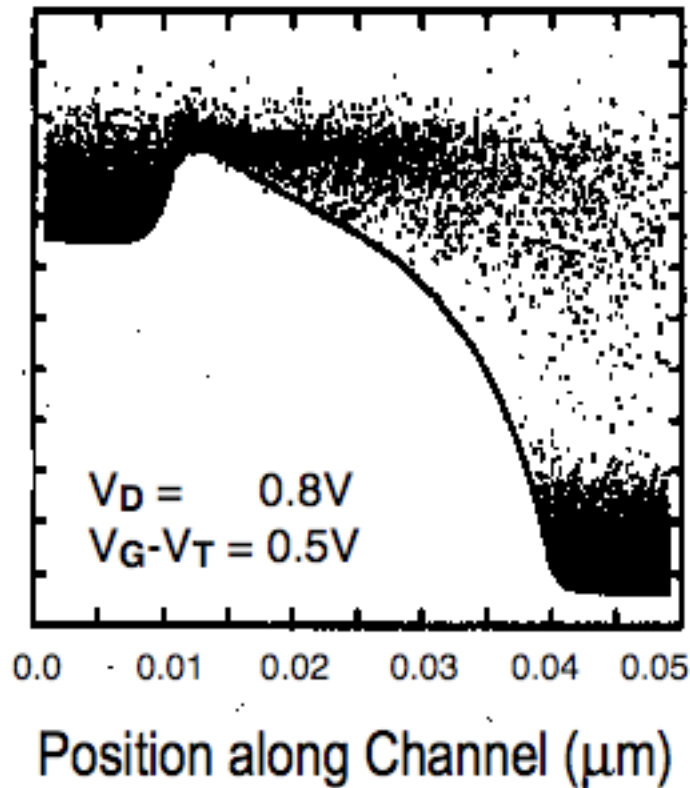
Device Physics of Nanoscale MOSFETs

Professor Mark Lundstrom
Electrical and Computer Engineering and
Birck Nanotechnology Center
Purdue University, West Lafayette, IN USA

nanoscale MOSFETs 2009

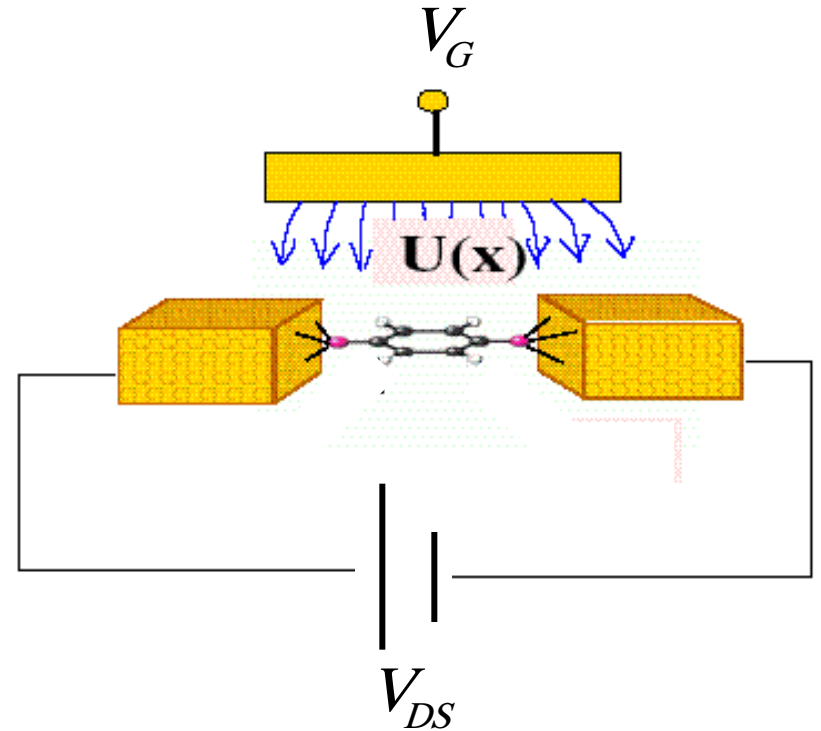
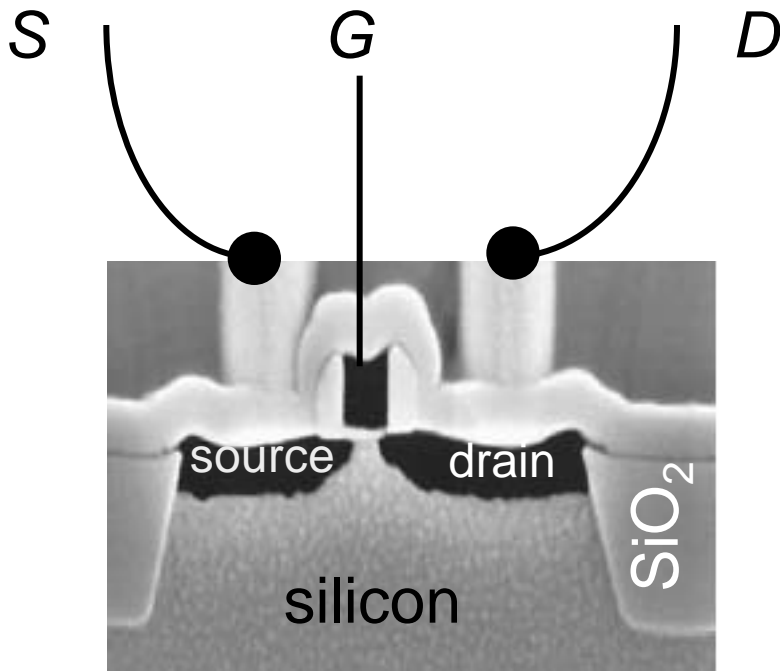


off-equilibrium transport nanoscale MOSFETs



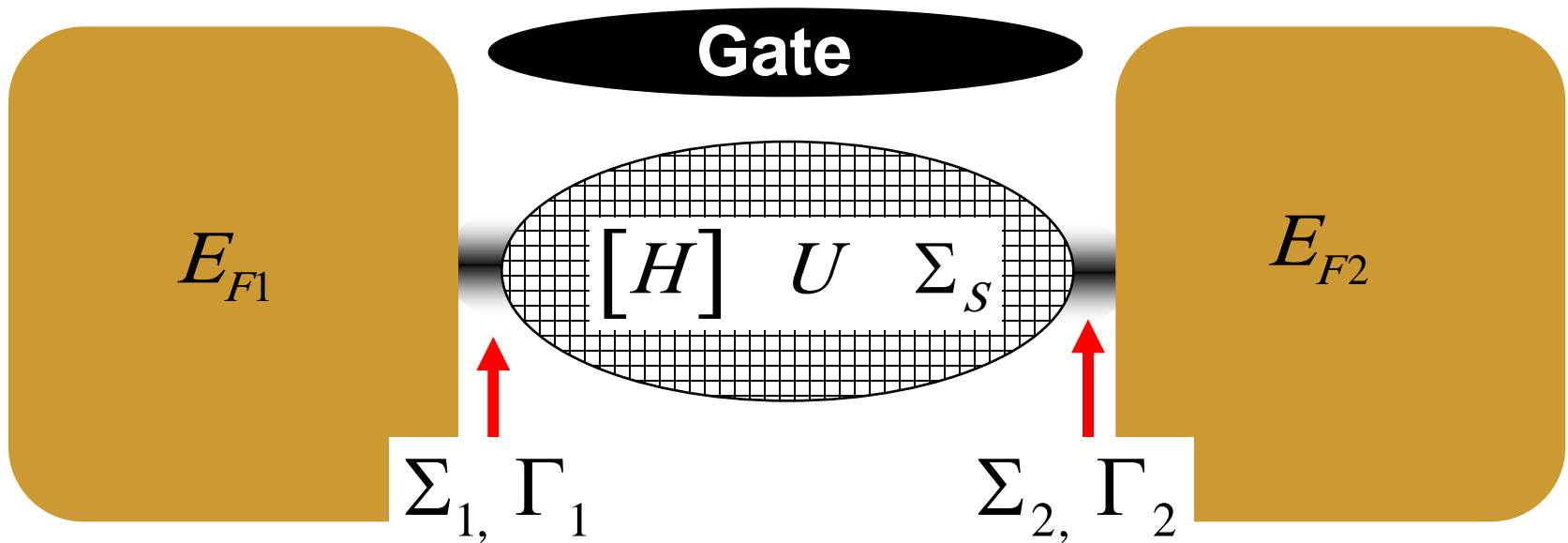
D. Frank, S. Laux, and M. Fischetti, Int. Electron Dev. Mtg., Dec., 1992.

nanoscale transistors



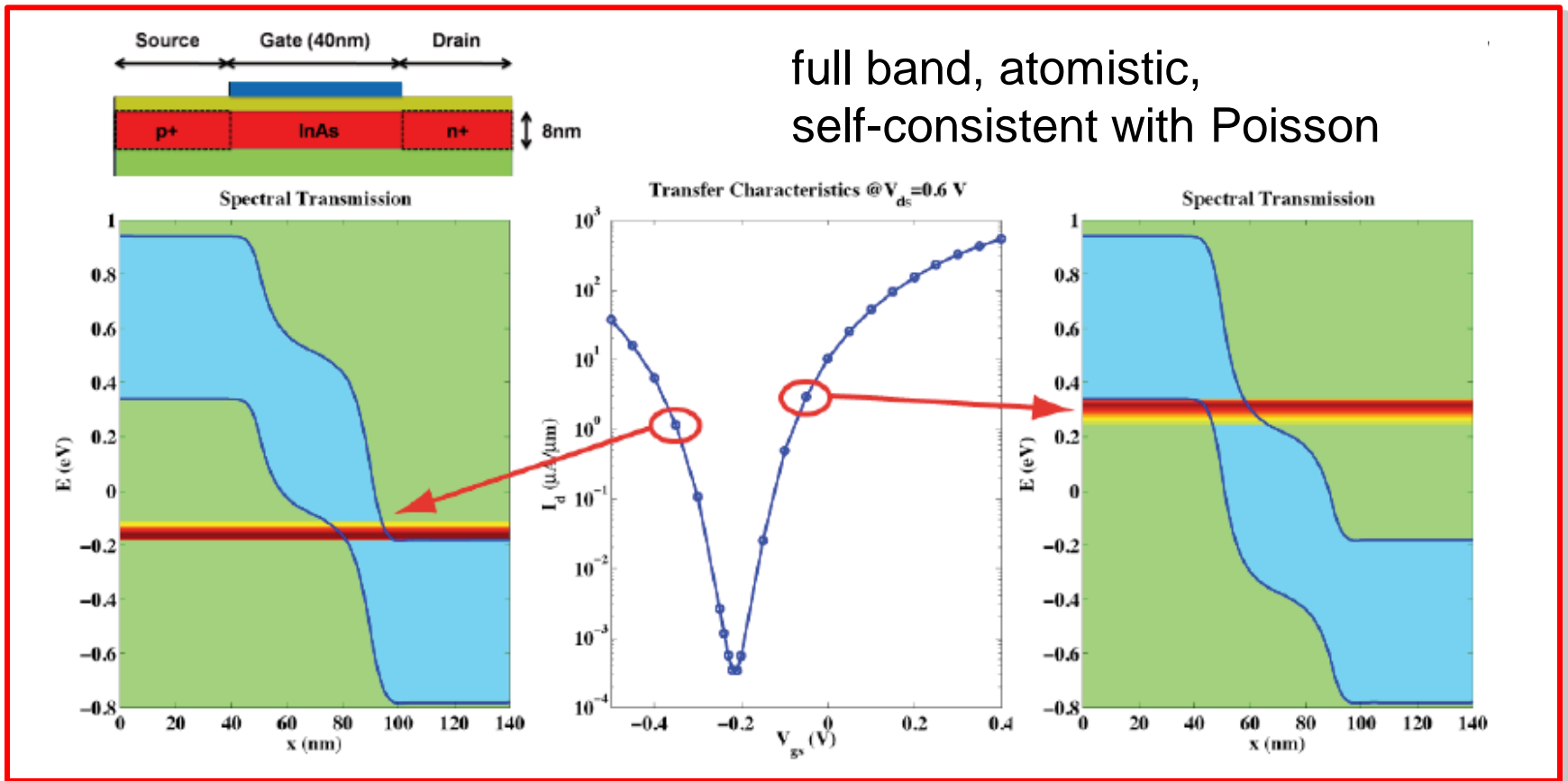
A. W. Ghosh, et al., *Nano Lett.*, **4**, 565, 2004.

NEGF simulation

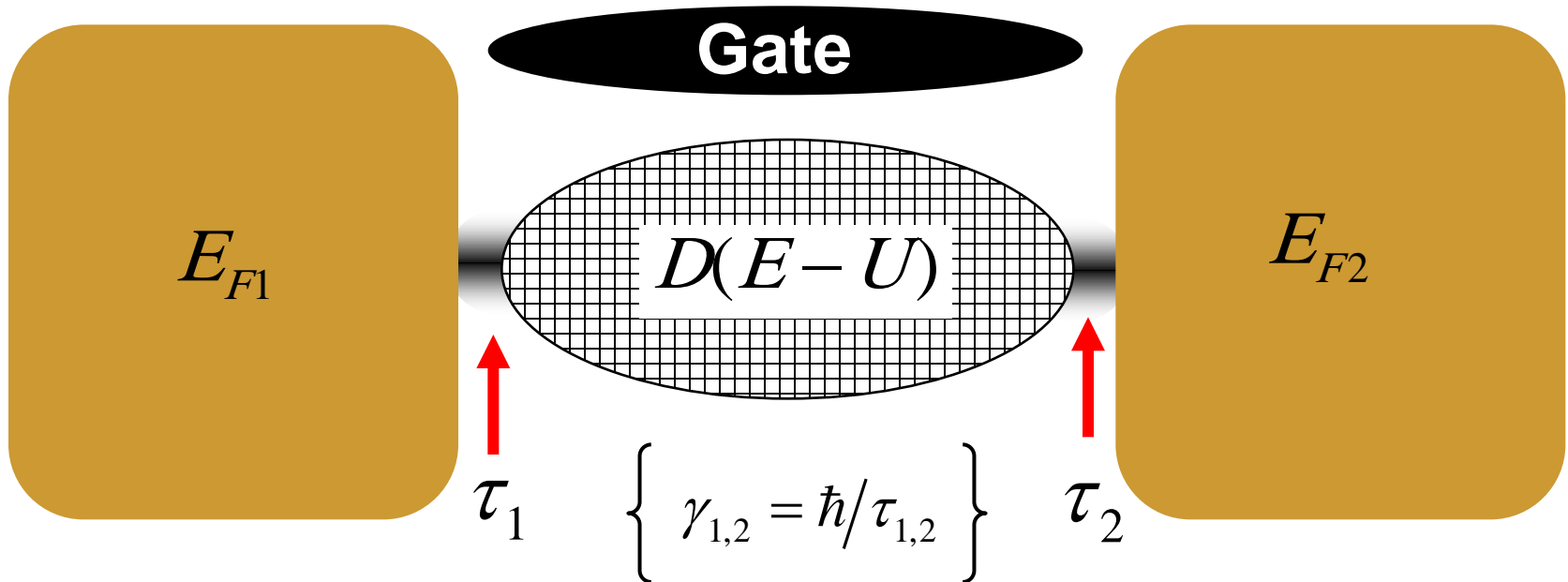


NEGF Resource page: <http://nanohub.org/topics/negf>

quantum transport in nanoscale MOSFETs



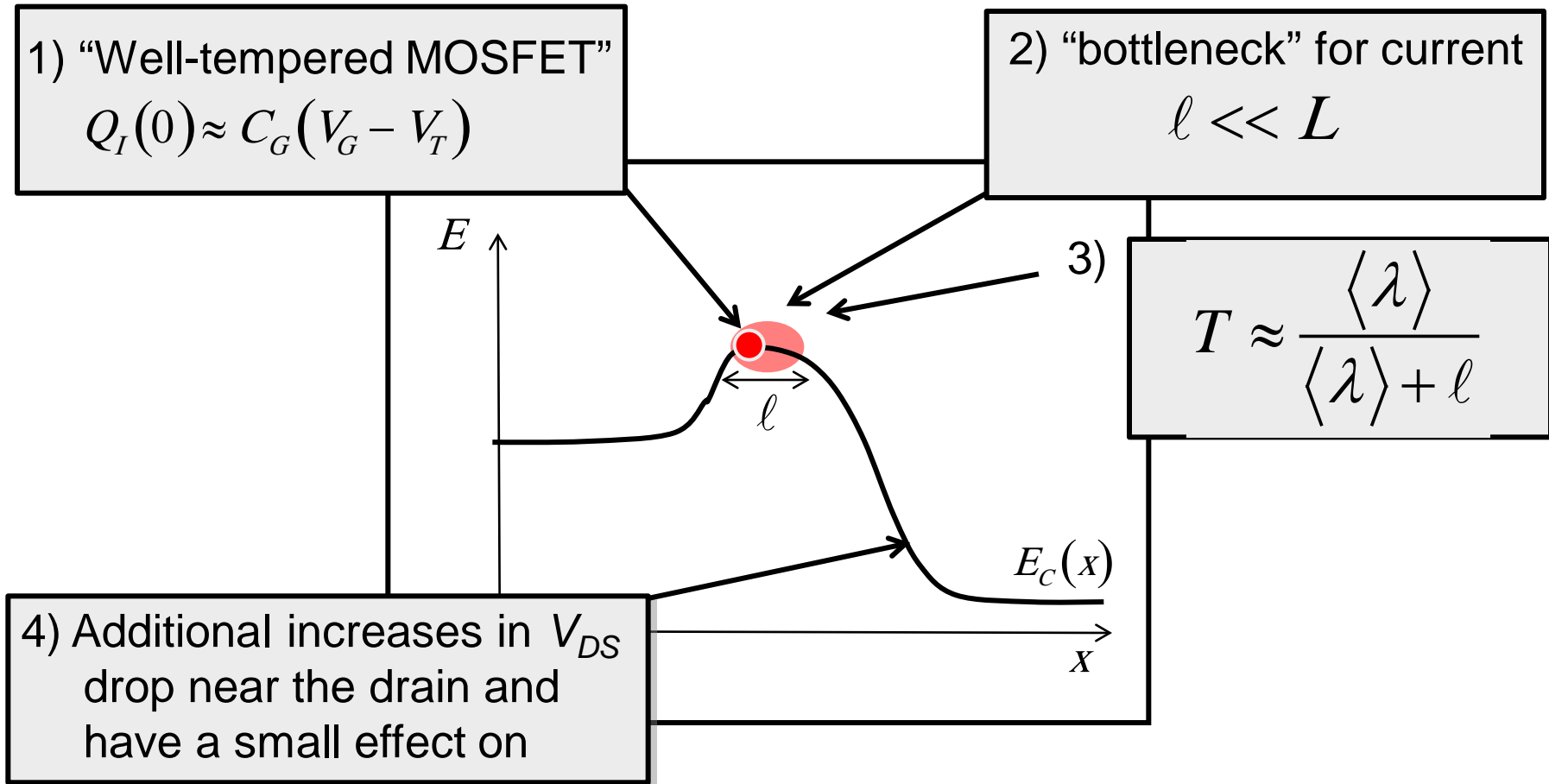
Datta's generic model



S. Datta: "Nanoelectronics: A Beginning Introduction"
<http://nanohub.org/resources/6580>

S. Datta: "Fundamentals of Nanoelectronics"
<http://nanohub.org/resources/5346/>

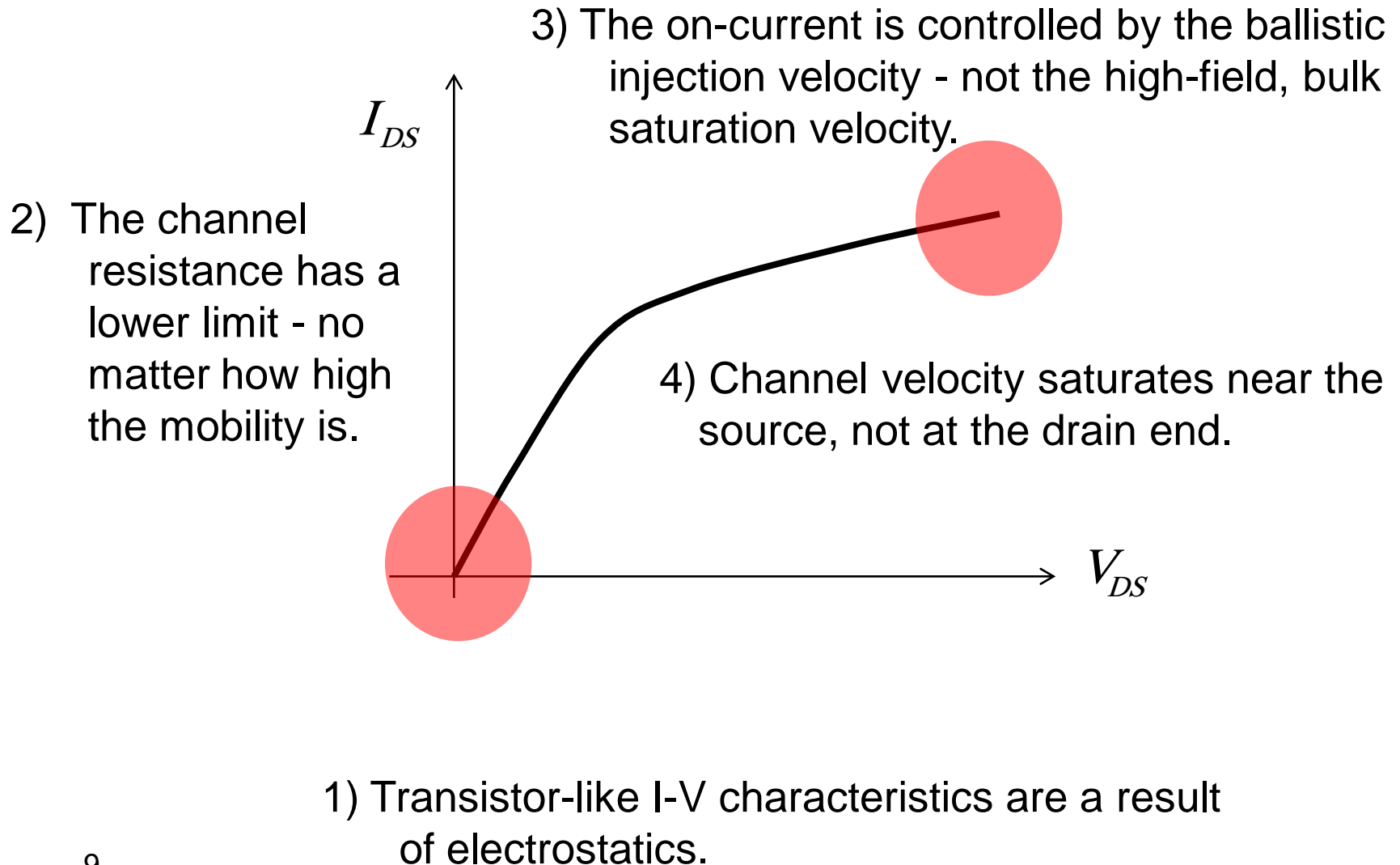
MOSFETs are barrier controlled devices



M. Lundstrom, *IEEE EDL*, **18**, 361, 1997.

A. Khakifirooz, O. M. Nayfeh, D. A. Antoniadis, *IEEE TED*, **56**, pp. 1674-1680, 2009.

physics of nanoscale MOSFETs



objectives of the lecture

- 1) Describe a simple, physical picture of the nanoscale MOSFET (complement, not supplement simulations).
- 2) Discuss ballistic limits and velocity saturation in nanotransistors.
- 3) Compare to experimental results for Si and III-V FETs
- 4) Identify ultimate limits for transistors
- 5) Discuss current research issues

finally....

Nanoscale MOSFETs are true nanoelectronic devices. Understanding them as nanodevices is a starting point for developing a sound and very general understanding of electronic devices at the nanoscale.

Semiconductor Electronics Education Committee

R.B. Adler, et al., 1960-1967



“SEEC was a triumph of engineering science, with a substantial, lasting impact... The approaches are still used in EE education throughout the world...”

-John Gutttag and Paul Penfield, MIT

in this seminar....

I hope to convey some important concepts about nanoscale MOSFETs but more importantly to encourage listeners to think about electronic devices in a new way.

An extensive set of instructional materials is available online.

Google “Electronics from the Bottom Up”

or

iTunesU - “Beyond Campus – nanoHUB.org

