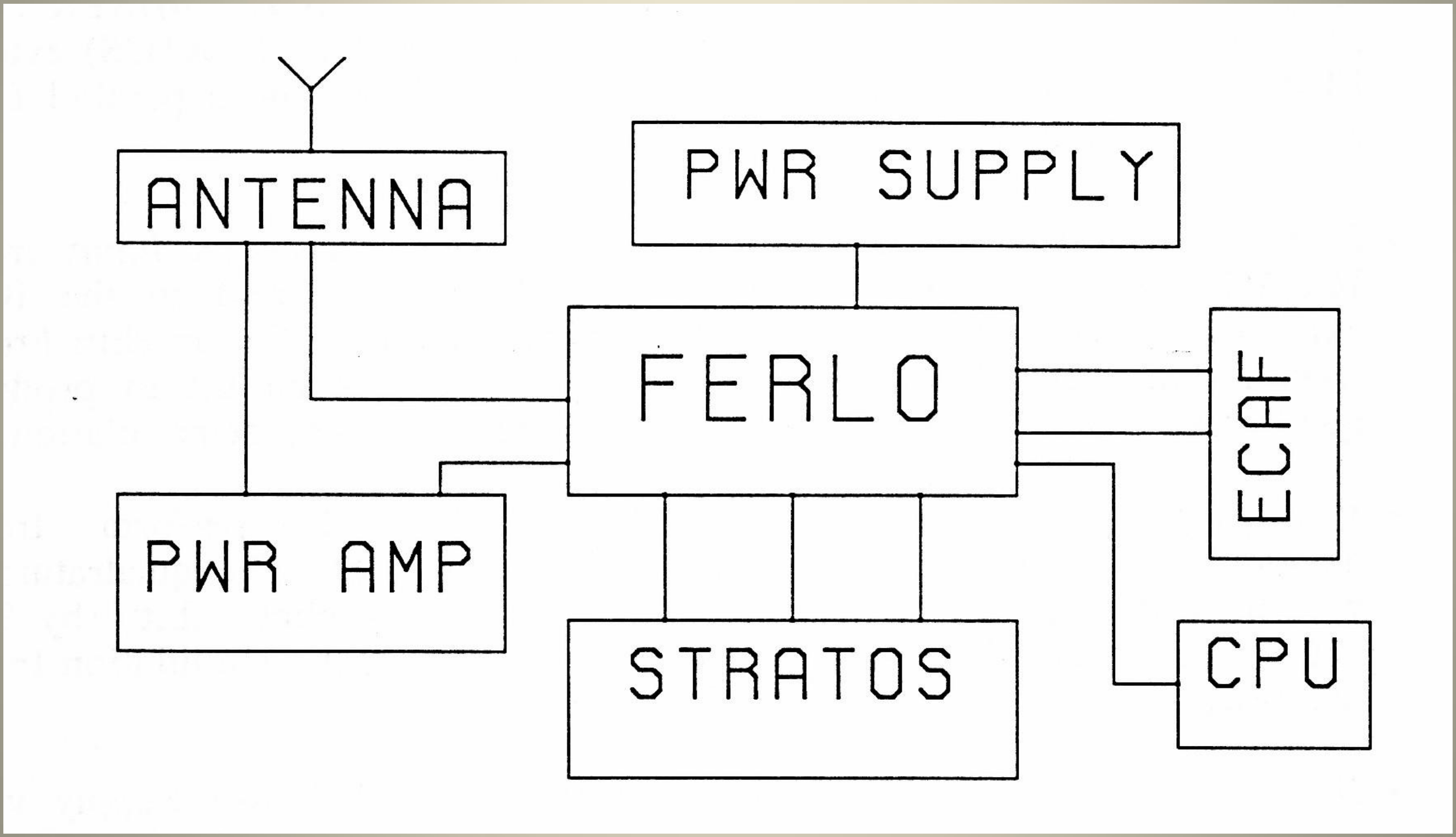
WHAT AFTER ELEC 312 ?

Design a complex Electronic System as an IC chip?

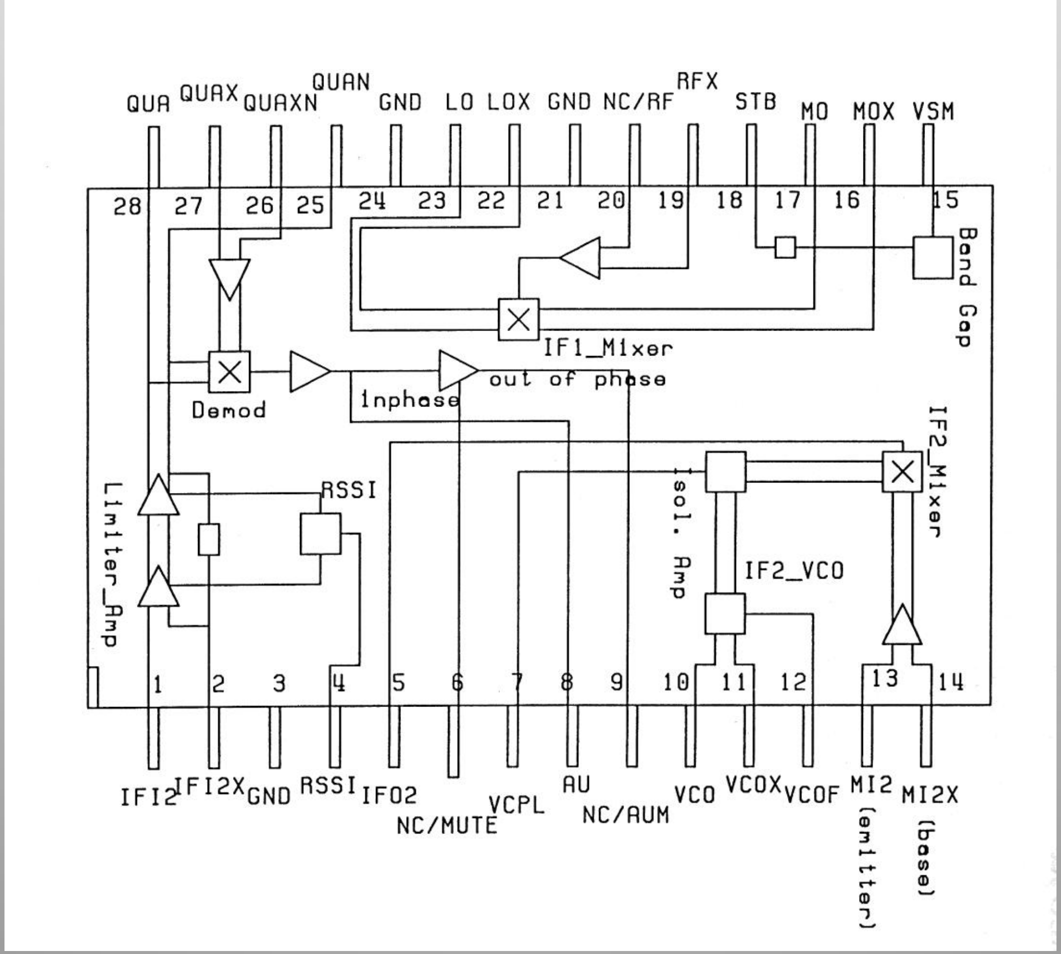
Explore what you can do with the emerging paradigms of Molecular (Nano) Electronics, Carbon Nano Tubes, Quantum dots (by 2030)?

System of IC chips in a Mobile Phone (Example)



FERLO Chip

(Front End Receiver Local Oscillator)



Functions (Partial List)

- IF1_Mixer: Receives input from a low-noise amplifier (LNA).It is driven by an UHF local oscillator (~900MHz-1200MHz). The IF is in the range of 80MHz to 120MHz
- IF2_Mixer: Receives input from the output of IF1_Mixer. Driven by IF2_VCO. The second IF is at 450kHz

Functions (Partial -II)

- IF2_VCO: It is a voltage controlled oscillator with a tuning range between 40MHz to 120MHz (partly covered in ELEC 312)
- Limiter Amplifier: A linear amplifier, receiving input from IF2_Mixer via a band-pass filter at 450 kHz. The gain is high ~90 dB (cascaded basic amplifiers chain with feedback and stability ensured – covered in ELEC 311,312)
- Band Gap: Supplies constant voltage/bias current irrespective of environmental variations (Introduction toAnalog VLSI ELEC 6051)

DC/AC specs-II

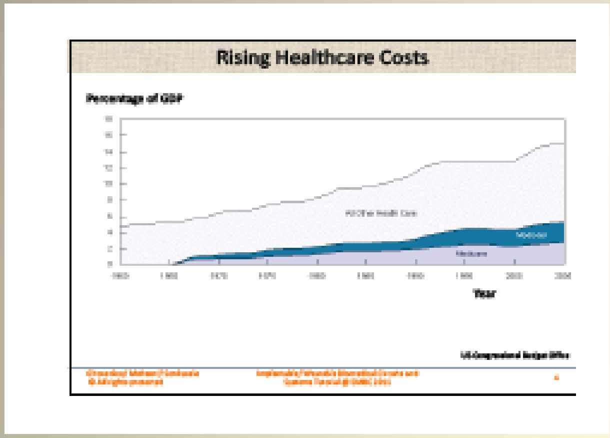
DC/AC CHARACTERISTICS *(contd.)*

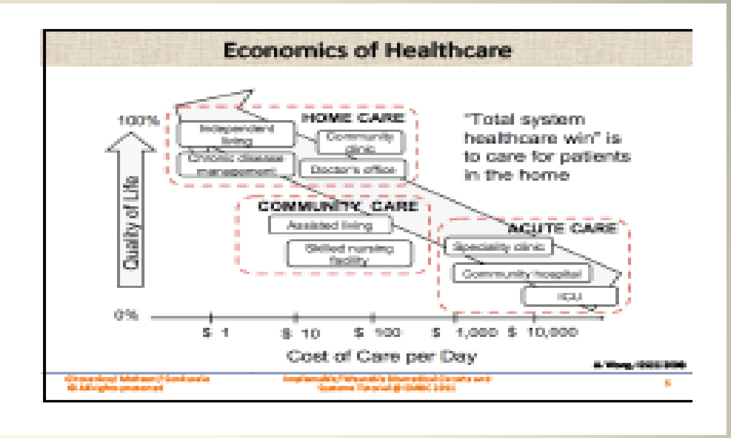
(DC/AC characteristics involve the spread of values guaranteed within the specified supply voltage and ambient temperature range. Typical characteristics are the median of production)

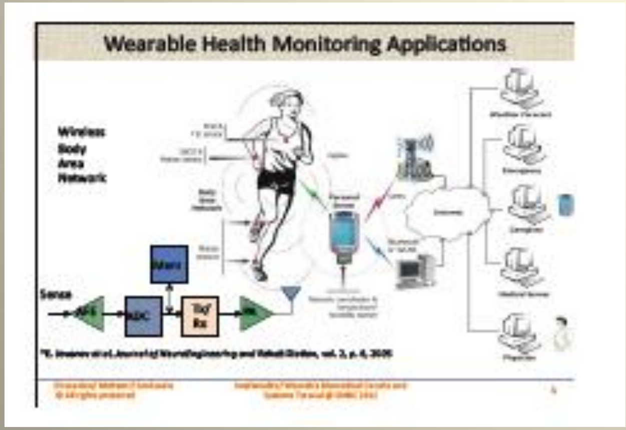
FERLO Rx

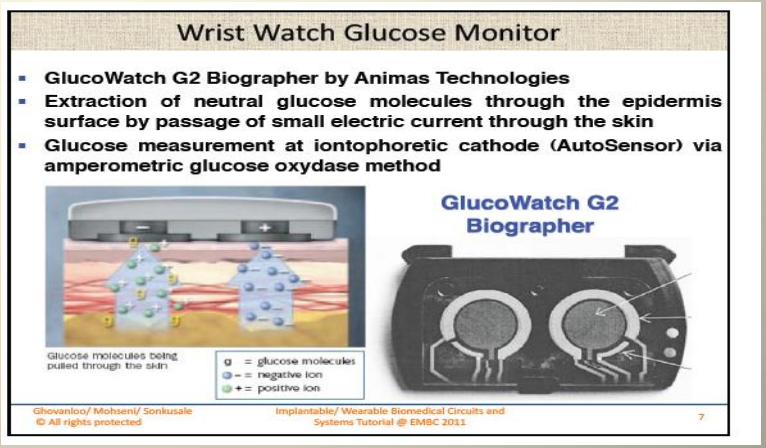
#Parameter	Symbol	Test Condition	Test Circuit	Min	Typ	Max	Units
Signal Input *RF/RFX*							
2. Input Resistance	$R_{RF/RFX}$	base AC grounded	Fig.6		50		ohms
3. Input Inductance	$L_{RF/RFX}$	In series with $R_{RF/RFX}$	Fig.6		10		nH
4. Max. Input Level	$P_{RF(max)}$	3dB Compression at MO/X referenced to RF input f_c=900 MHz	Fig.4	−10	−8		dBm
5. Intercept Point(3rd) (input)	P_{IP}	Referenced to RF input, f_c=900 MHz, carrier separation=60kHz (see applic.spec.)	Fig.4	3	4		dBm
6. Blocking Level (input)	P_B	3dB Attenuation of wanted signal at MO/X	Fig.4	−14	−10		dBm
7. Input Interference level at $f=f_{int}$	P_{int}	−98dBm Interference @$f=2(f_{int} \pm f_{L01})$ at MO/X, f_c=900MHz	Fig.9	−38			dBm

Wearable Electronics-I

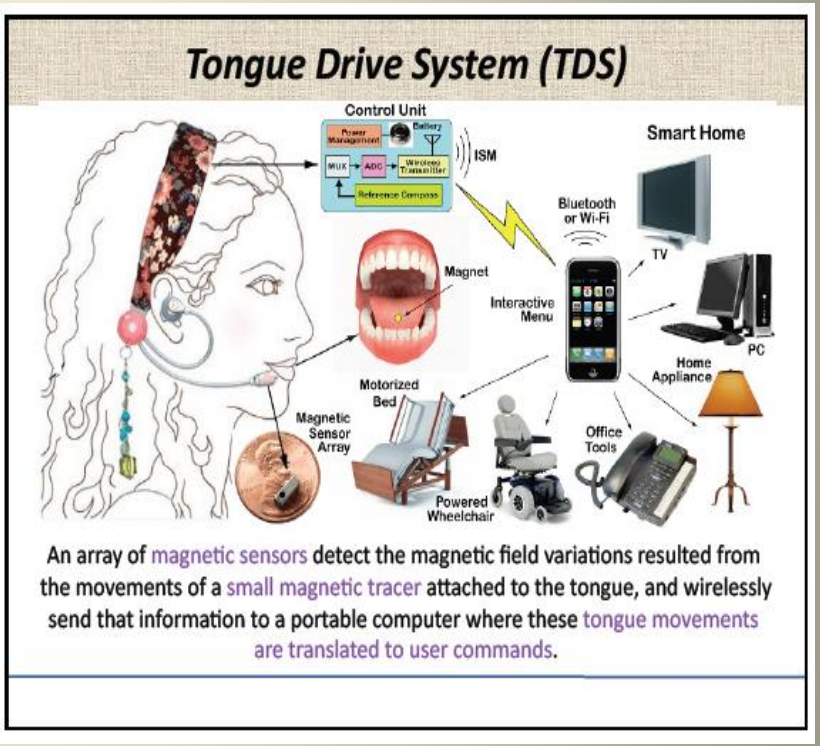








Wearable Electronics-II



Molecular Electronics-I

Sergey E. Lyshevski, “Molecular Electronics, Circuits and Processing Platforms”, CRC Press, © 2008

- The designations such as microelectronics, nano-electronics, molecular electronics etc. should not be ascribed to ‘feature’ dimensions, but preferably by the relative size of the basic device (i.e., a diode) compared with the size of the fundamental charge carrier (electron/hole/ion/..) in the device. The ratio of the sizes influences the physics/chemistry of operation and hence emerges new paradigm of analysis and verification.
- In microelectronic devices, individual molecules and atoms do not depict the overall device physics and do not define the device performance, functionality and capabilities.

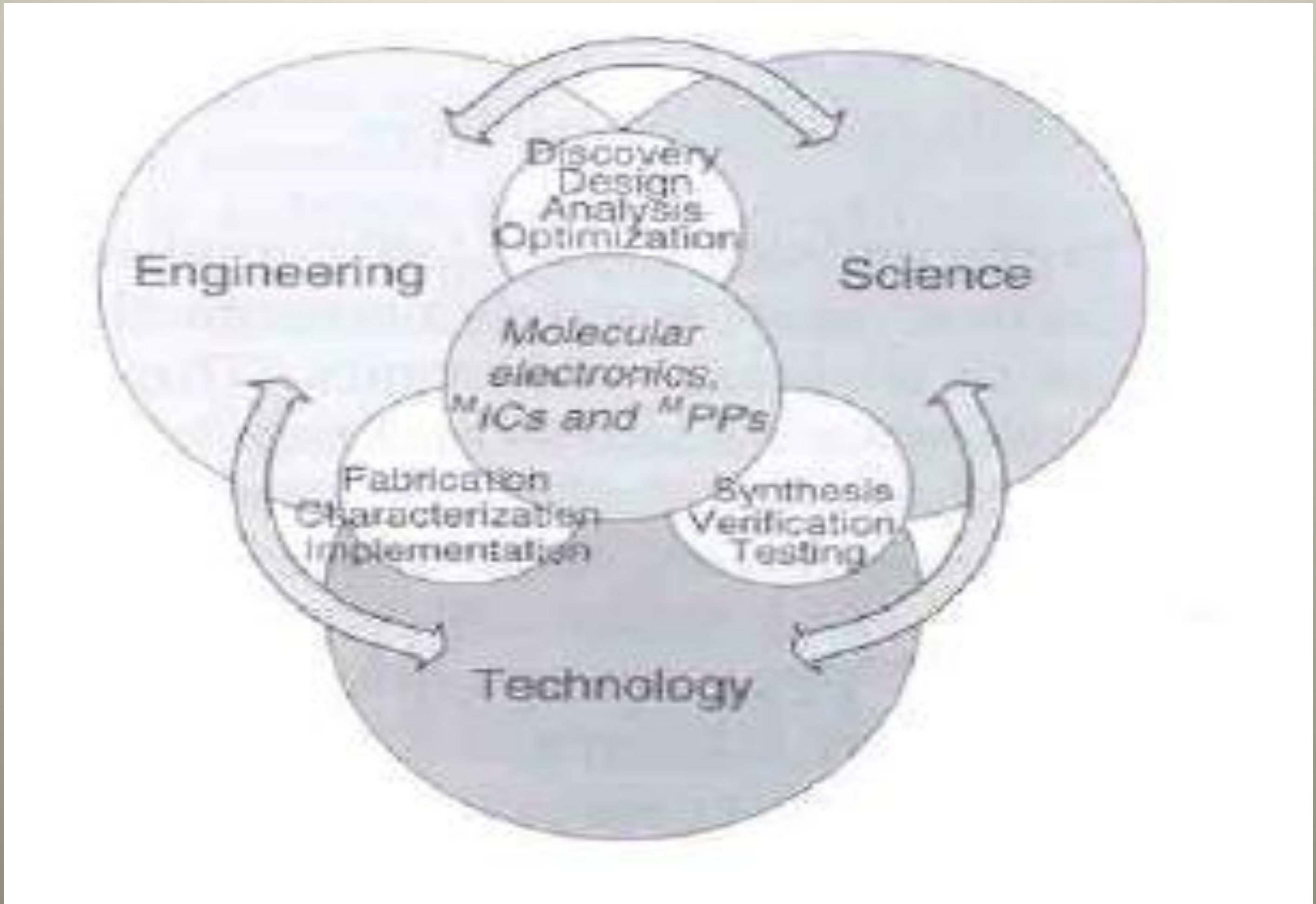
Molecular Electronics-II

Sergey E. Lyshevski, "Molecular Electronics, Circuits and Processing Platforms", CRC Press, © 2008

- In molecular devices , individual molecules and atoms explicitly define the overall device physics depicting the device performance, functionality, capabilities and topologies.
- DNA is a charged polymer. Over most of the pH range, the backbone of a DNA polymer carries one free negative charge per base. As an electro-negative molecule, DNA in solution can be moved with electric fields. This technique is called electrophoresis.
- One of the areas nano-technology is expected to have significant impact on in terms of paradigm change and large scale economy is nano- electronics. As scaling down of CMOS transistors reaches a limit, the alternatives could be molecular electronics, carbon nanotube-based nano-electronics, single electron transistors, and so on. Nano-wires hold the prospect of fabricating vertical surround gate transistor.

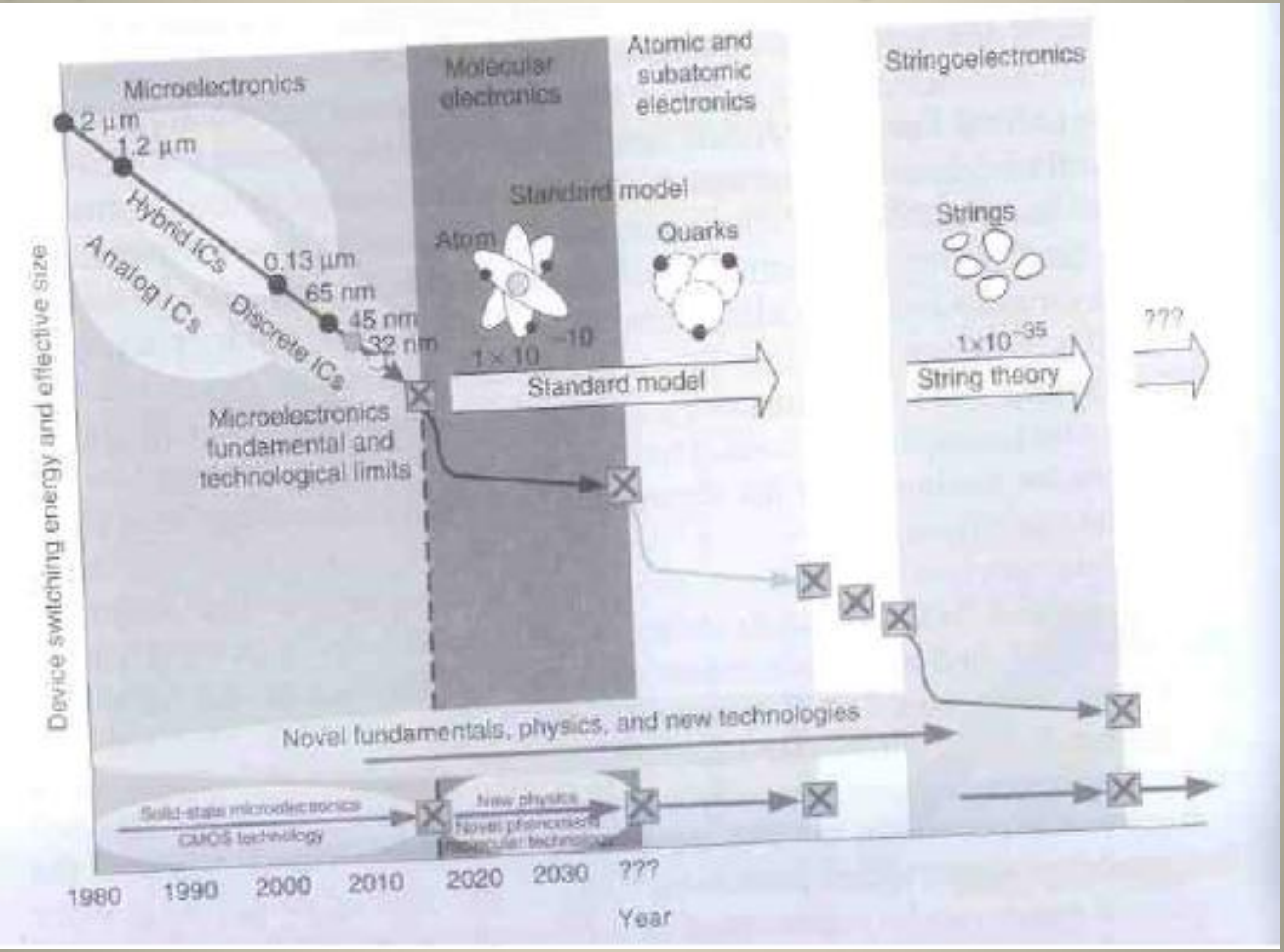
Molecular Electronics-III

Sergey E. Lyshevski, “Molecular Electronics, Circuits and Processing Platforms”, CRC Press, © 2008



Sting electronics !!

Sergey E. Lyshevski, "Molecular Electronics, Circuits and Processing Platforms", CRC Press, © 2008



String Electronics- II

Sergey E. Lyshevski, “Molecular Electronics, Circuits and Processing Platforms”, CRC Press, © 2008

- Atoms (~100 pm dia) contains microscopic particles like protons, neutrons and electrons.
- Protons and neutrons form the nucleus (~0.001 pm dia)
- A hydrogen atom has about 100 pm diameter
- A string is estimated to have a diameter of ~ 10E(-35) m
- Thus about 10E(25) strings could fit into the diameter of a single hydrogen atom!
- Molercular electronics is likely to progress to *atomic* and *sub-atomic* elerctronics and to *string-electronics* and further- when?..May be in 1000 yrs.

ELECTRONICS -II

A Come Back!