Session 4 - Si-based Nanoelectronics (I)

The following points were discussed:

- **Traditional scaling**
  - Scaling is a reality: 90nm ➡ 45 nm ➡ 22nm
  - Lithography as a key enabler: From 65-32nm: 193nm laser line, below: EUV
- **Equivalent scaling (MOSFET): Challenge of the introduction of new concepts**
  - Increase of mobility by strain
  - Increase of C_{ox} ➡ low EOT ➡ high k materials
  - Scaling down of L_g (lithography), result: short channel effects ➡ Need for new transistor architectures
- **Memory: what drives the technology**
  - Integration density (use of 3rd dimension)
  - Consumption (read/write: speed, stand-by: non-volatility)
  - Correction of a defective information storage

Si-based Nanoelectronics (II)

- **The “universal” memory**
  - Dense (DRAM)
  - Fast (SRAM)
  - Non-volatile (NAND, NOR)
  - Scalable
  - Low power
  - Reliable

  Future potential candidates: Charge trapping devices (flash, FeRAM), Resistive devices (PCRAM, MRAM, RRAM…)

- **Interconnects: a major challenge**
  - No technological breakthrough is expected in the short term
  - Find design and manufacturing solutions

- **Physical limits**
  - Present CMOS – limits at the atom scale
  - Other ideas on how to process information should emerge
  - No visible alterative technology at present

    (RTD- ‘80s: never achieved high complexity circuits, SETs - ‘90s: Convincing demonstration only on special devices of low complexity)

Si-based Nanoelectronics (III)

- **Economical challenge**
  - Monthly sales are reduced
  - Evolution of product diversity
  - Each company has its own priorities
- **Design – technology interaction: Wishful thinking or real need?**
  - Problem of variability with scaling down
  - Circuits are more sensitive to technology
  - Design-technology interaction is a must
- **More than Moore: the next frontier?**
  - MtM vs. MM market share ~20%
  - A wide diversity of products. No established CMOS-like legacy process/device
  - Roadmapping? Effort started (in ITRS and in Catrene). Led by Societal needs, Lead markets, Applications