



**NANO-TEC**

## 4th Workshop: Elaboration of Recommendations

### Charge-based State Variable

Rapporteurs:

**Guilhem Larrieu (CNRS-LAAS)**

Convenior:

**Mart Graef (TUDelft) and**

# Discussions:

## 1. Discussion of several potential cases:

- How to deliver beyond CMOS technologies to designer: Process Design Kit (PDK)
- If graphene based transistor is a reasonable candidate for logic?
  - Need to open the gap -> will reduce the mobility which is the first motivation for graphene.
  - Mobility = high speed is not the 1st requirement for beyond CMOS? The main requirement is to address the power challenge.
  - Material quality
  - Stability
- 3 issues:
  - Integrability: dense circuit integration.
  - Systemability= design
  - Manufactability= physical aspect

## 2. Necessity to have design people close to the development of techno

## 3. Interconnect possibilities/opportunities should be take into account

# RECOMMENDATIONS

- With respect to nanowires, theoretical understanding of the underlying physics, material science is necessary. The interplay of the physical properties of nanowires (electronic, optical, thermal, mechanical, e.g., strain, interfaces, interface states, surface chemistry, and associated metrology) still require investigation their effect on device operation and on variability, both of which impacting on architectures and integration prospects.
- The combination of nanowires technology with III-V compounds or alternative architecture (TFET) should be regarded as a promising beyond CMOS device, where a particular attention on the CMOS compatibility (for example III-V integration on Si platform) is required.
- Establish a carbon-nanoelectronic program with specific quantitative targets for carbon-based technologies to assess the possibility and test the suitability of fabrication and integration constraints for a combined Si-carbon (graphene) new ICT technology, beyond sensors and single components. Other promising layered materials could be explored as alternatives.

# RECOMMENDATIONS

- With respect to molecular electronics, for information processing of the post CMOS era, more interaction between the design and device communities is required to exploit the full potential of molecules properties. For analog applications, especially sensing, a connection between molecular electronics and flexible electronics may provide new possibilities with a better maturity level.
- Interconnect aspect should be taking into account
- It is essential that strong collaborations are established between the technology and design communities, even during the research stage. Each nanoelectronic project should have a design partner.

# DESIGN FACTORS

IDEA HERE IS TO INCLUDE POINTS TO BE REINFORCED IN THE DESIGN-TECHNOLOGY SECTION  
SEE DRAFT RECS

## Challenges in design of this set of device technologies:

- Xxxx
- Xxxx
- Xxxx