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**GOVERNING ultraFAST the conductivity of correlated materials**

*Developer and user of electronic models.*

*Meeting on EU Policy on modelling, simulation and design.*

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# Vision on where modelling in industry should go:

The development of realistic modelling of strongly correlated materials enabled to improve our ability to exploit and manipulate them for technological application.

Emerging next generation technology: **ultra-fast control of correlated materials properties.**

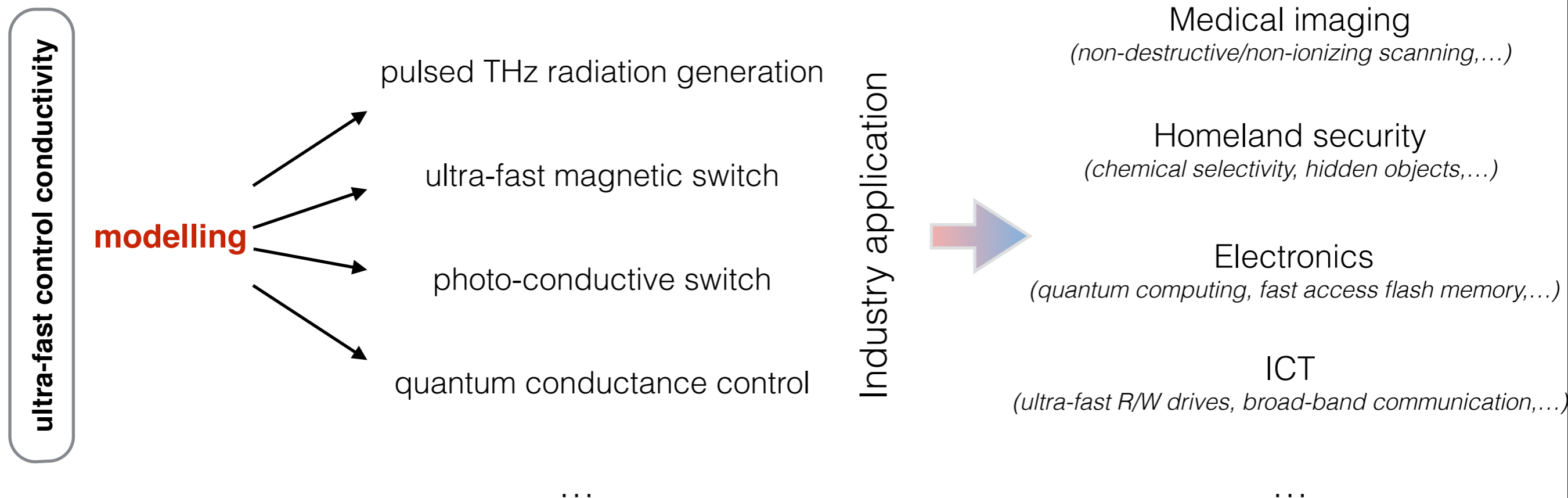
- Strengthen the collaborations between materials scientists and industry designers/engineers/developers, in particular focusing on the light-matter interaction.
- Model based engineering of novel materials with exotic and tailored electronic properties, governed on the sub-nanosecond scale (*e.g. high-temperature superconductivity, thermoelectric power, colossal magneto-resistance, etc.*).
- Integrate efforts to achieve greater miniaturization at and below nano-meter scale of electronic devices.
- Combine real-time modelling of electronic processes into materials models, design and manufacture (far looking)

# Modelling the optical control of conductivity in quantum materials.

***benefits if vision is realised***

## Key possibility of ultra-fast control correlated materials conductivity

HUGE POTENTIAL APPLICATION IN DIFFERENT BRANCHES OF TECHNOLOGICAL DEVELOPMENT.



# *Future research road map*

The modelling of non-equilibrium phenomena in quantum materials is at early stage of development.

Fast development in the next few years.

## **Goal: develop realistic modelling for industrial application**

- - Large imbalance between experimental results and theoretical-modelling
- + + Europe hosts some of the most important groups working in the field.

### *(some)* **Obstacles to industrial use of ultra-fast modelling:**

- A. Lack of a standard theoretical setup and thorough understanding.
- B. Modelling actually focuses onto fundamental problems: scaling to realistic materials is mandatory with proper down-folding.
- C. Fill the gap between microscopic electronic properties and macroscopic description: possibly long multi-scale / multi-physics structure.

## **Necessary activities and support from by EU in materials modelling:**

- i. Coordinate against work fragmentation and redundant work: different groups and/or companies focusing on similar problems spread in EU.
- ii. Favour the exchange of ideas and cross fertilization, views and techniques at different scales of the time-resolved modelling (*electronic, ab-initio, mesoscopic, photonics,...*).
- iii. Support the synergy with industrial partners: shape the actual modelling, enable the technological spin-off, transfer of competences.
- iv. Setup training sites to expand present pioneering work (*Marie-Curie Training, finance and support scientific projects within ERC, etc..*)
- v. Enhance visibility of the time-resolved modelling and optical control.

**Thanks a lot...**