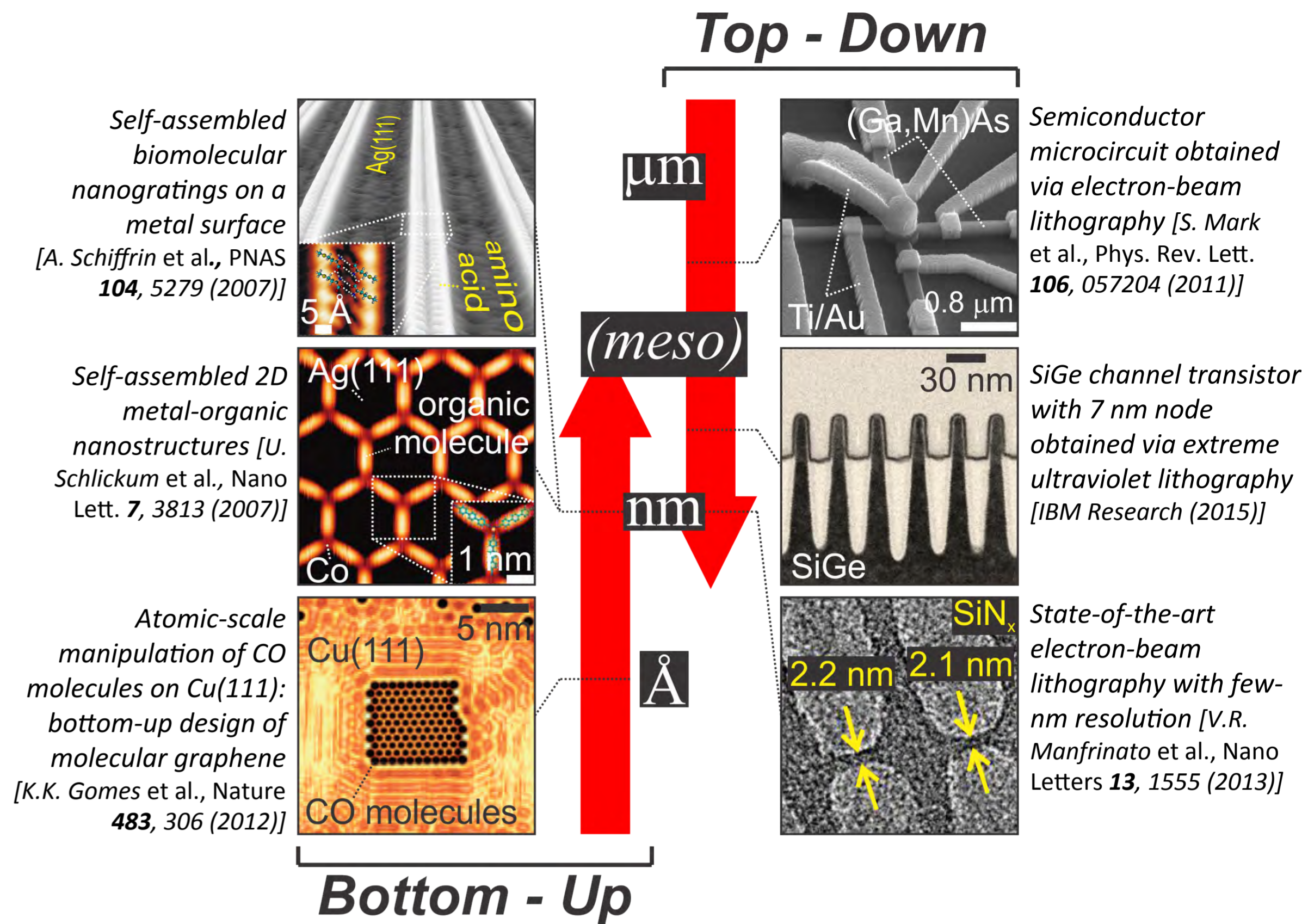


# Atomic-Scale Engineering of Low-Dimensional Materials

## Nano-Materials with Programmed Functionality, from the *Bottom-Up*

Electronics, optoelectronics, information, catalysis and biosensing technologies rely on devices, where electronic processes take place at the interface of functional materials, at the atomic scale. Conventional device fabrication involves 'top-down' techniques (e.g. lithography): materials are patterned by *removing matter*, with resolutions of, at best, several nanometres. Our group employs methods of **supramolecular and metal-organic self-assembly on surfaces, to synthesise functional materials from the 'bottom-up', via programmed interactions of atomic and molecular building units**. This approach ensures **exquisite atomic-scale structural control**, allowing to **tailor the electronic, optoelectronic, magnetic and chemical properties** of the targeted materials. It enables atomically precise synthesis of **low-dimensional organic materials** with novel electronic properties, yielding promise for **ultrafast and dissipation-less electronics**, efficient **photovoltaics**, cost-effective **catalysis**, surfactant design, **biosensing** and **spintronics**.

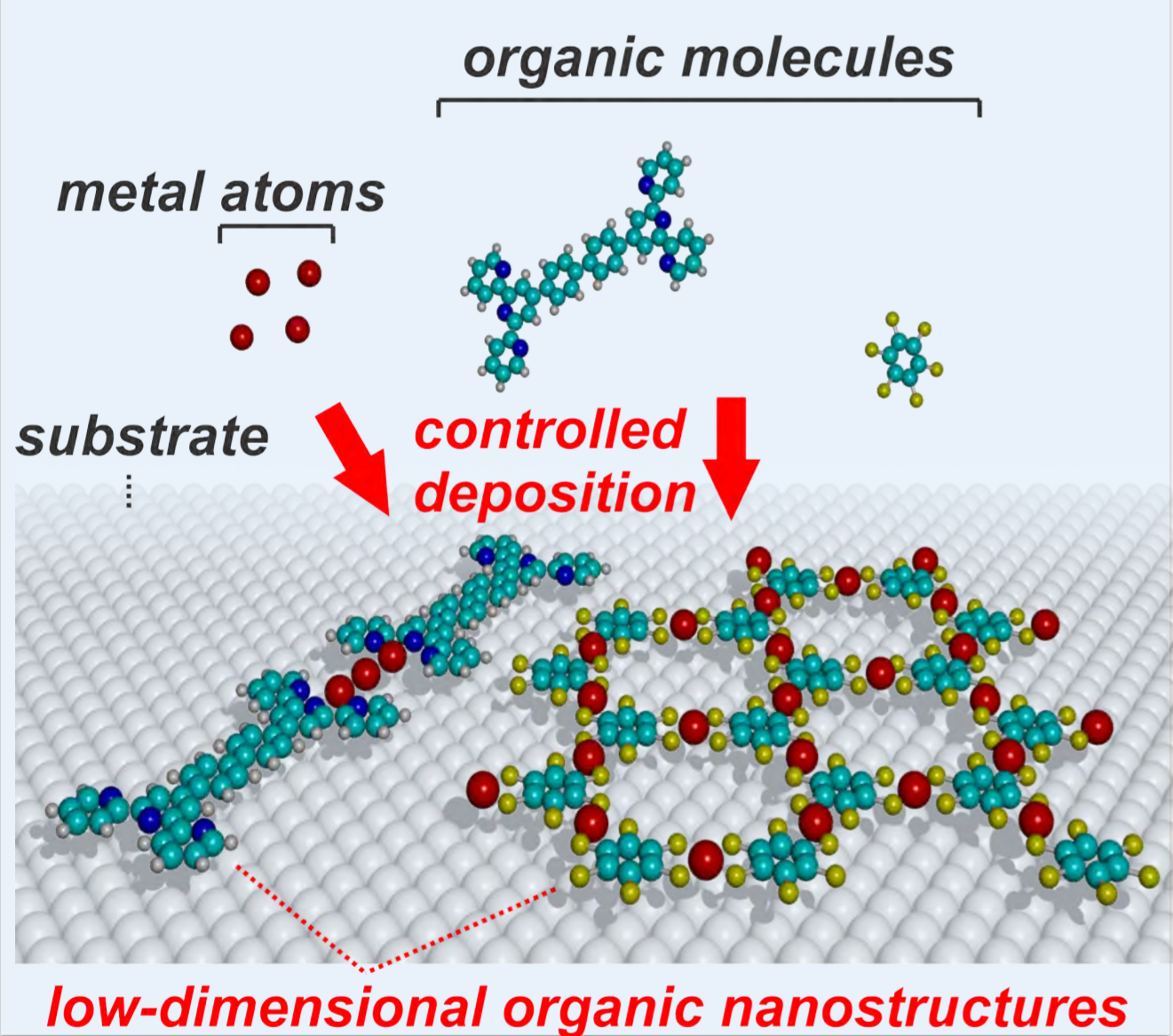


## Lead Scientist

Dr. Agustin Schiffrin

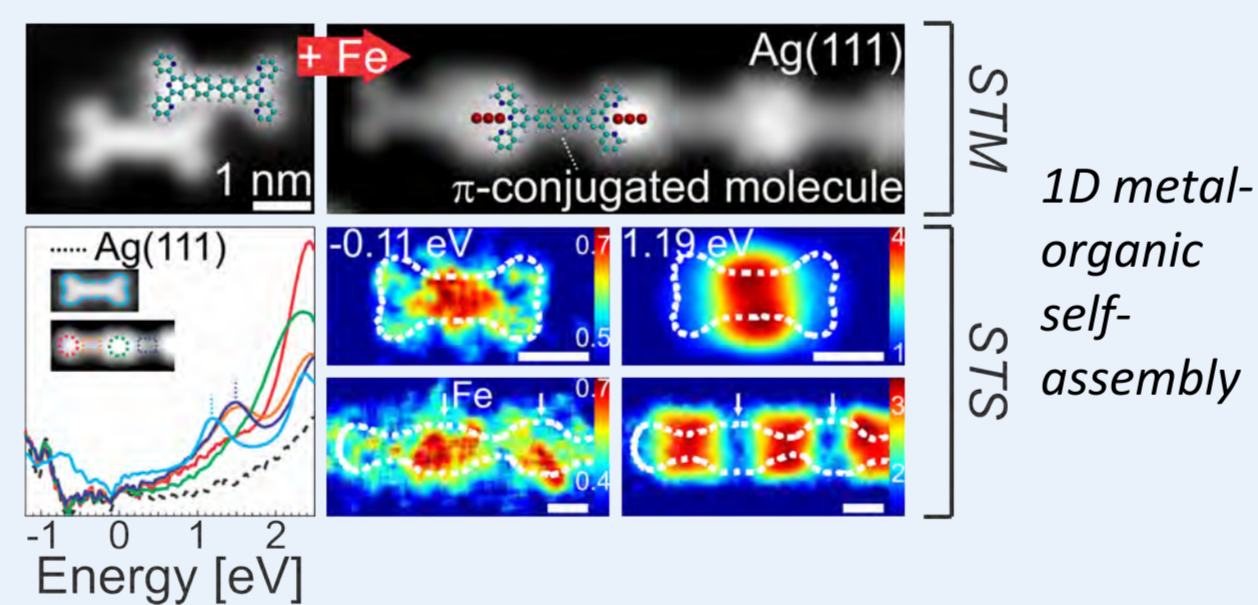
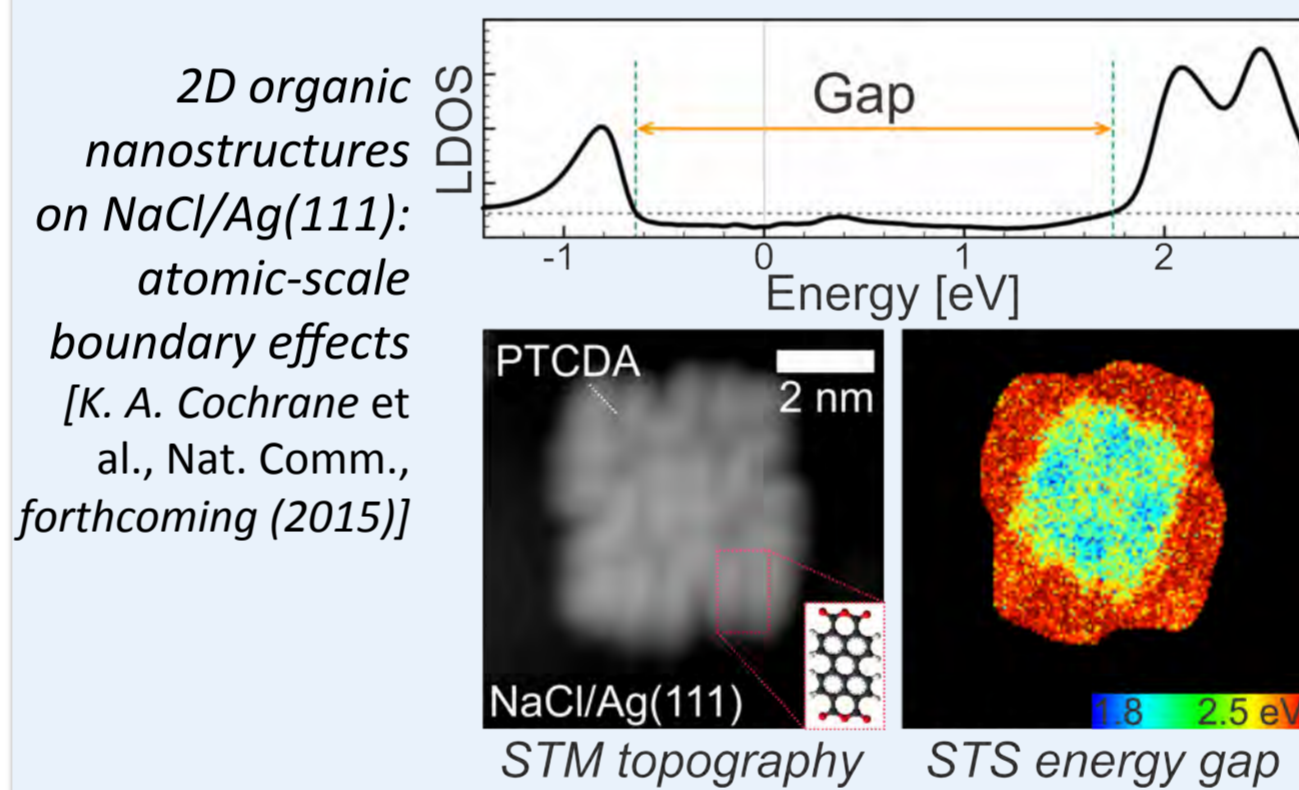
## Research Expertise

- Organic and metal-organic **low-dimensional self-assembly** on surfaces
- Atomic-scale control** of structure and **electronic properties** at surfaces
- Low-temperature **scanning probe microscopy** and **spectroscopy**
- Synchrotron-based **x-ray spectroscopies**
- CW and time-resolved **photonics**

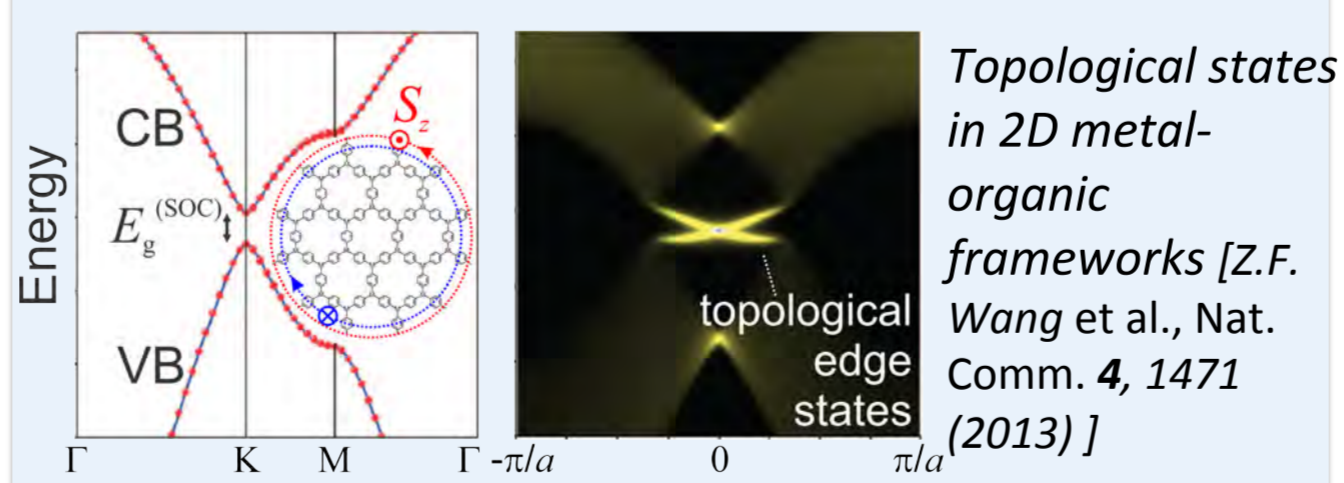


## Applications

Tuning optical absorption and photo-induced charge dynamics of nanopatterned interfaces via atomic-scale structural control: **organic photovoltaics** (donor-acceptor and DSSC), **photocatalysis**



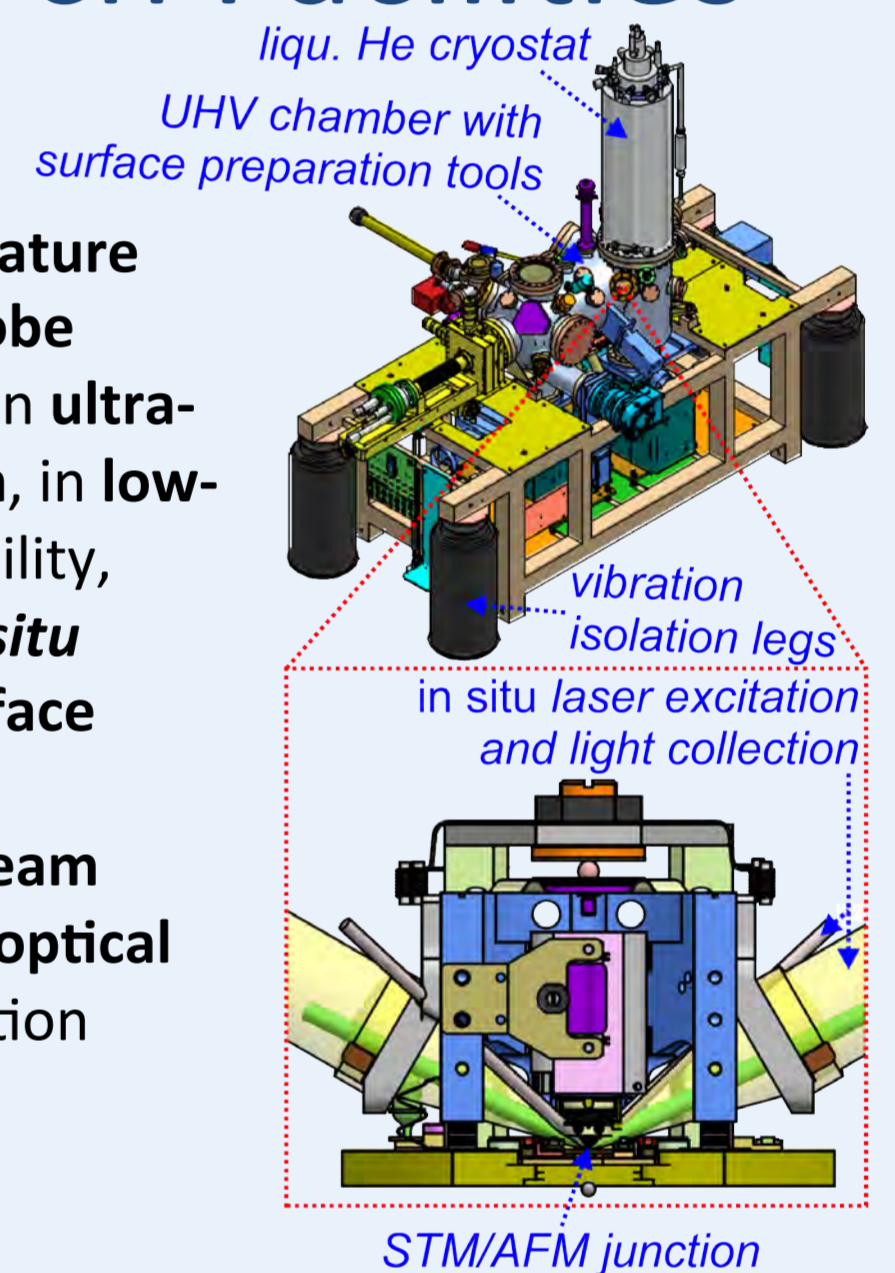
- Quest for low-dimensional organic nanostructures with non-trivial, highly conductive electronic phases (e.g. topological insulators): **dissipation-less nanoelectronics**
- Control of atomic-scale magnetic order: **memory storage, spintronics**



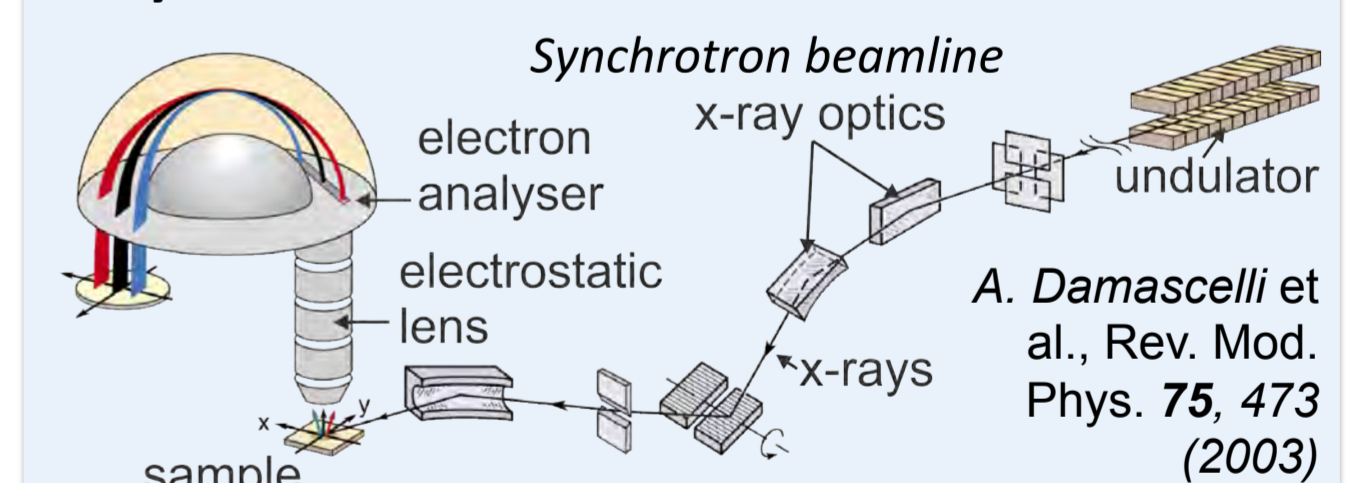
Atomic-scale control of surface reactivity: **heterogeneous catalysis, surfactants** for froth flotation mining, molecular recognition (e.g. **biosensors**), gas storage

## Research Facilities

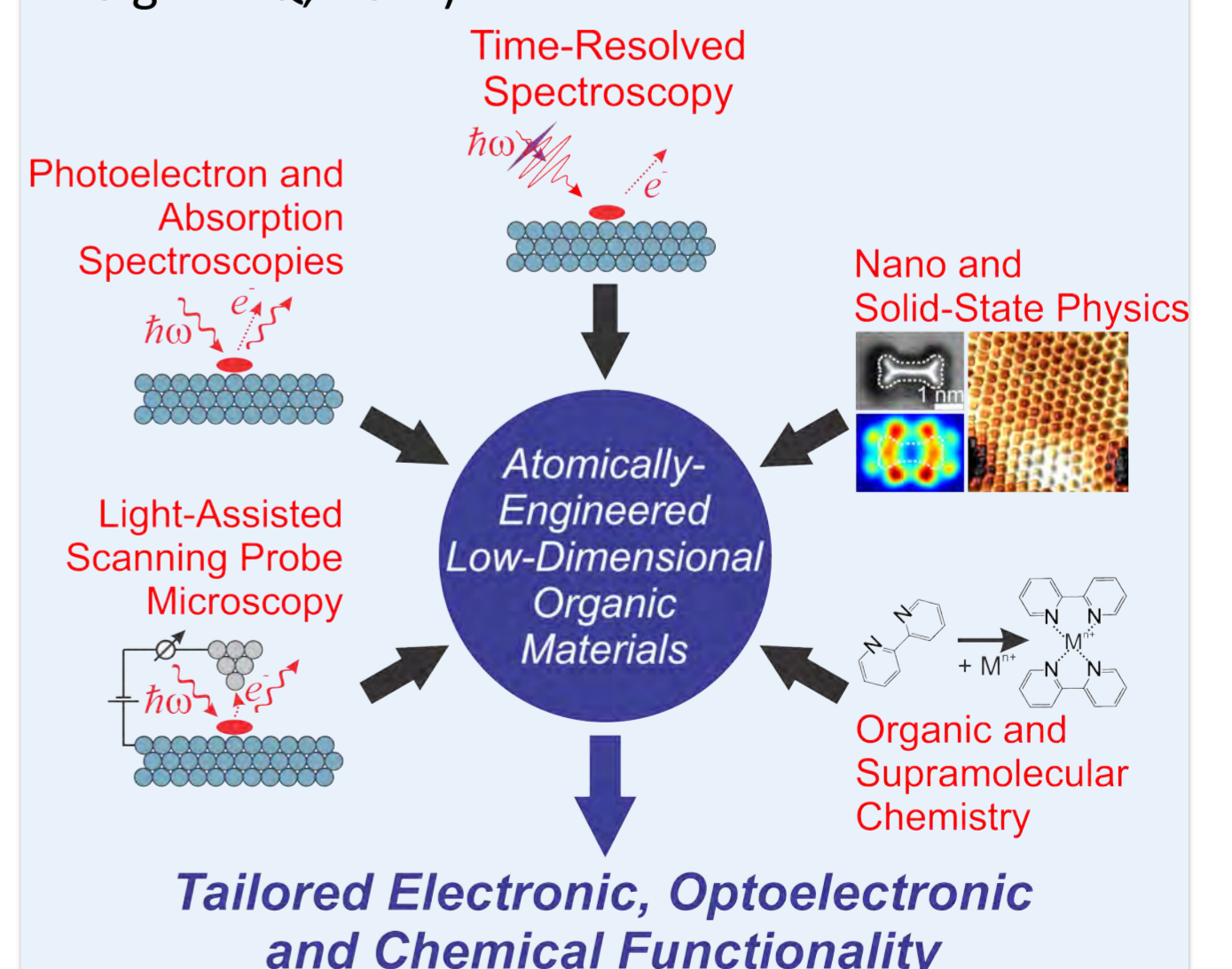
- Low-temperature scanning probe microscopy** in ultra-high vacuum, in **low-vibration** facility, including *in situ* tools for **surface preparation, molecular beam epitaxy** and **optical characterisation**



- Chemical and electronic characterisation** (XPS, NEXAFS, ARPES) at **Australian Synchrotron**



- Ultrafast charge dynamics** via **time-resolved spectroscopies** (international collaborations e.g. MPQ, TUM)



## Key Contact

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