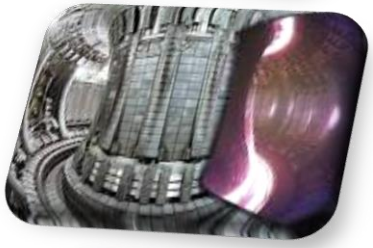
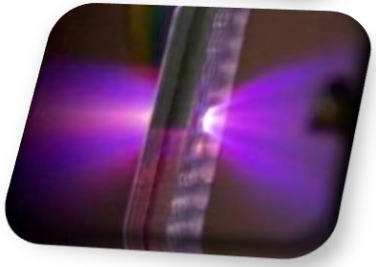
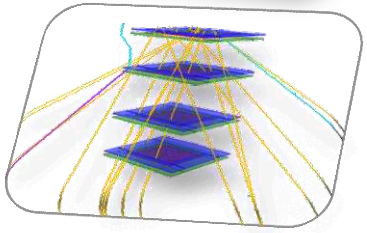






SUPA Energy Theme

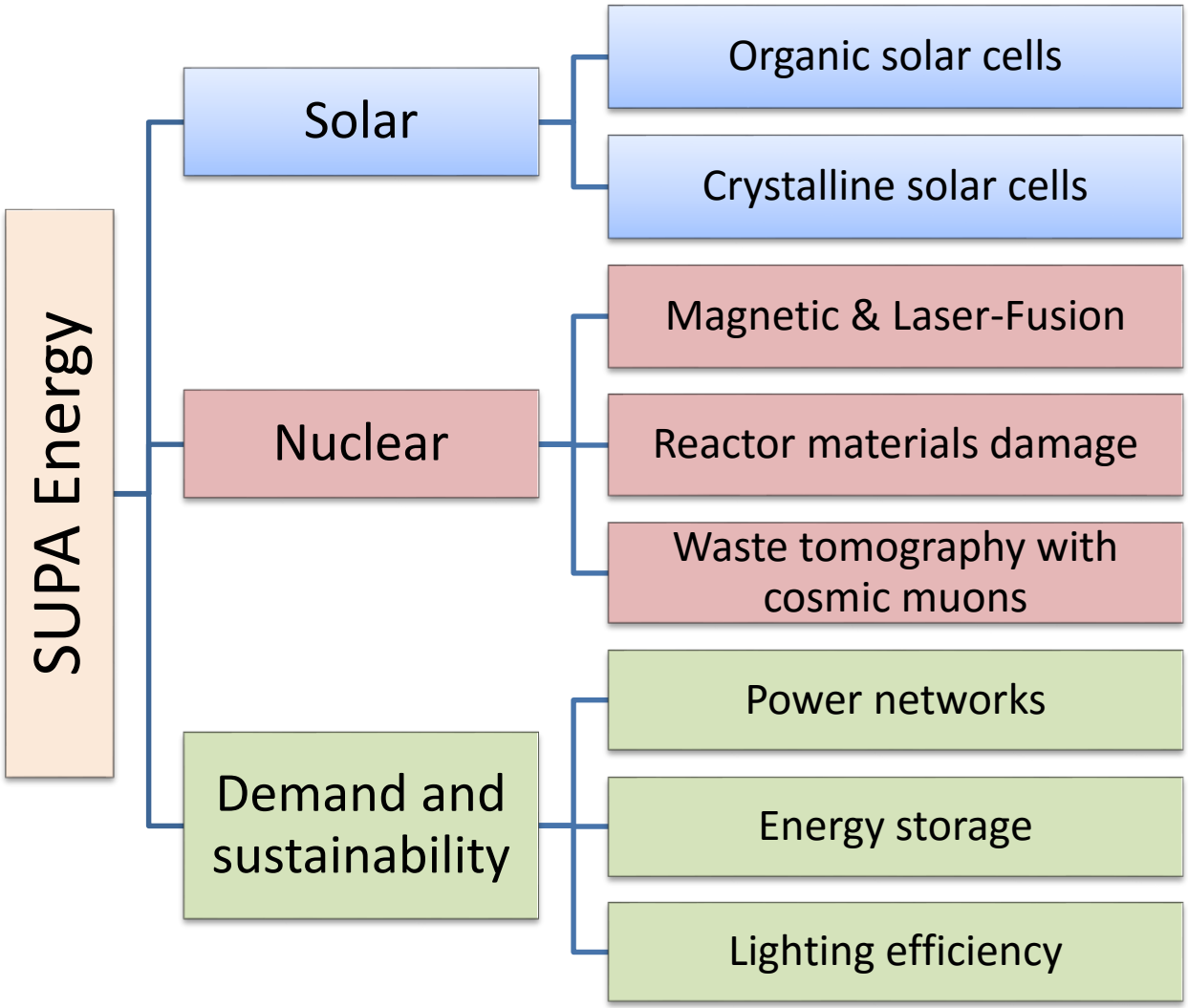
Theme Management Committee:

Paul McKenna (Strathclyde) – Theme Leader

Ifor Samuel (St. Andrews)
Murilo da Silva Baptista (Aberdeen)
Job Thijssen (Edinburgh)
Steve Reynolds (Dundee)
Des Gibson/Klaus Spohr (UWS)
David Hamilton (Glasgow)
Taj O'Donovah (Heriot-Watt)

Theme overview

- ~25 academics, ~30 postdocs, and ~40 PhD students across the 8 SUPA institutions with energy as a core element of their research
- Almost all members of this theme are members of other themes



Common link:

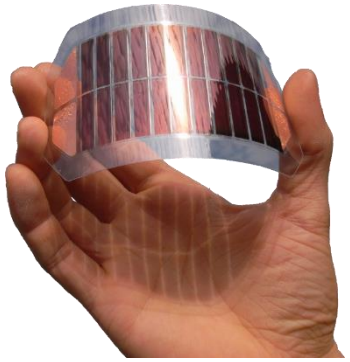
Materials for Energy

- Thin film solar cells
- Material damage for reactors
- Thin film lighting solutions
- Thin film coatings for oil pipelines, marine, fusion reactors
- Materials for advanced laser-fusion targets
- Soft materials for energy storage

Solar physics

Significant grants:

- EPSRC Organic photovoltaic materials; £328k
- EPSRC Capital for Great Technologies £3.7M
- ERC Adv. Investigator Award on Exciton Diffusion €2.1M
- EPSRC Flavins and quantum dots for solar cell £685k
- EPSRC Conjugated Polymer Devices £450k
- Programme grant applied for Li-Fi in which organic solar cells will be used to harvest power indoors for the internet (St. A, Strath, Edin)



High profile publications:

- *Advanced Materials* 2015 on Electron transfer in photovoltaic donor-acceptor blends
- *J. Phys. Chem. Letts.* – Exciton diffusion in photovoltaic blends
- *J. Mater. Chem. A* – efficient quantum dot sensitized solar cells – highly downloaded article
- *SPIE Journal of Photonics for Energy* - Invited review "The role of photonics in energy"; Special paper for the international year of light.

Solar physics

Prize:

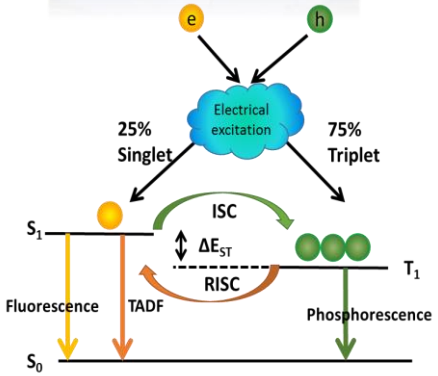
Royal Society of Chemistry Chemical Dynamics Prize for Ifor Samuel (St Andrews) for time resolved spectroscopy to understand photophysical processes -in organic solar cell and light emitting materials

Collaborations, Impact and Knowledge Exchange:

- International collaborations: Rutgers University, Stanford, Changchun university, +….
- SMEs – e.g. Kelvin Probe Technology in Wick on measurements of the energy levels and photovoltage of organic semiconductors
- A project with Xanthella on light harvesting for growing algae for biofuels (Graham Turnbull)
- EastCHEM, WestCHEM and SISER, through grants
- Projects between St. Andrews, Heriot Watt, Dundee, Strathclyde

Training:

- Enhance PG training via energy PhD projects within the Photonics & Condensed Matter CDTs



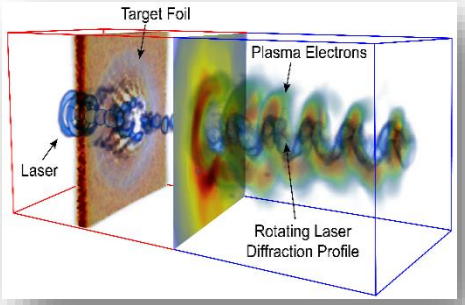
Fusion and legacy nuclear waste

Funding examples:

- EPSRC: ADAS magnetic fusion: £330k
- EU – EURATOM
- EPSRC: Modelling of turbulence in tokamak physics £303k
- Sellafield contract: tomography of legacy nuclear waste
- EPSRC: Physics relevant to advanced ignition schemes for ICF: £1.4M

High profile publications:

- *Nature Phys.* – Controlling collective charged particle motion driven by lasers (advanced ignition-ICF)
- *Nature Comm.* – Stimulated Raman scattering (ICF-relevant)
- *Nat. Scientific Reports* – laser-driven ions (advanced ignition-ICF)
- *J. Phys. B.* - Highlights of 2015 collection – Excitation data for W
- *Phys. Rev. A* - First paper of large-scale tungsten DR Project for ITER



Fusion and legacy nuclear waste

Collaborations and Impact:

- continuing engagements with JET and ITER
- EPSRC-funded UK IFE network & COST-EU IFE network
- Collaboration and impact via Culham and RAL
- Collaboration with Sellafield on muon tomography
- International knowledge exchange/training ADAS workshops at the leading fusion laboratories in China, Korea, Japan, Germany, France

Other:

- First Proton Fast Ignition International Consortium experiment funded on ORION at AWE – planning in progress for 2017 (Strathclyde-led)

Training:

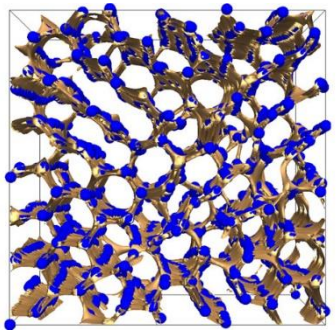
- Related Strathclyde-CDT and studentships in partnership with Culham and Central Laser Facility, RAL

Storage and Lighting

EPSRC
Engineering and Physical Sciences Research Council

Funding:

- EPSRC Ultra-parallel visible light communications £4.6M

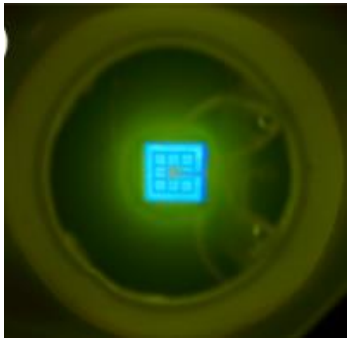


High profile publications:

- *Fuel* – "Comparison of Raman and IR spectroscopy for quantitative analysis of gasoline/ethanol blends" (Dundee)
- Paper on "Modelling, controlling, predicting blackouts" (Aberdeen)

Collaborations and Impact:

- WestChem, EastChem
- Joint project between Strathclyde, St. Andrews, Edinburgh, Dundee, Aberdeen
- Collaborations with many UK groups (Cambridge, Imperial College, + many others…)



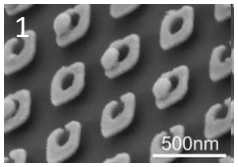
Training:

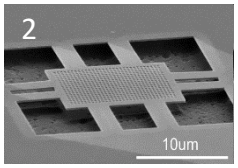
- Studentships via Condensed matter and Photonics CDTs

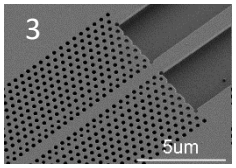
New SUPA-funded Cleanroom facility at St. Andrews

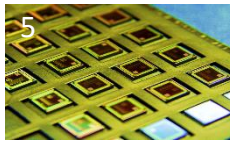
The new clean room (funded by SUPA) will house advanced nanofabrication facilities, enabling the development of new electronic and photonic materials and devices.

Devices Fabricated









Devices include: 1.Metamaterials. 2. Filters. 3. Photonic Crystals. 4. OLEDs. 5. Organic Electronics

Facilities

- **Two photolithography systems:** To produce sub-micrometer structured for use in optoelectronic devices
- **Electron beam lithography system:** produces features 10 000 times smaller than a human hair
- **Organic and inorganic evaporators:** used to deposit nanometre-thick layers of materials
- **The wetdecks:** provide areas for safe use of chemicals, ensuring any hazardous vapours are extracted from the working area.
- **The glovebox:** a nitrogen-filled workspace allowing for the preparation and storage of atmosphere-sensitive samples.
- **Optical microscopes :** used Inspection and characterisation of samples.

Summary

- High impact publications across our energy research activities
- Collaborative work across SUPA in solar, lighting and nuclear; Links to several international projects and networks
- Strong links to the EastCHEM, WestCHEM and SISER research pools
- Building new links to SMEs; Engagement with large fusion projects
- Building links with the Energy Technology Partnership