Electro-Optical Modelling of Photovoltaic Devices

Developing and releasing open-source codes specifically designed to model the electronic and optical response of inorganic solar cells, notably III-V solar cells and silicon tandem solar cells, to a high level of accuracy using computer simulations.

Competitive advantage

- Ideally suited for III-V thin-film solar cells and silicon tandem architectures
- Code is scriptable and scalable, allowing applications from CAD for individual solar cells through to estimating energy yield from PV systems
- Integrated optical constant and semiconductor parameter database
- Python has been used as the base programming language making the code multi-platform
- All codes are open source, allowing collaborators to run the simulation freely

Impact

- Software released publicly on a dedicated website
- Sourcecode available on the GitHub repository
  - SolCore PV device model
  - RayFlare PV optics model

More Information

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Successful outcomes

- A 28.3% single junction concentrator solar cell was designed using the SolCore code in conjunction with a spin-out company, Quantasol
- The energy yield from a commercial triple-junction solar concentrator system was calculated using SolCore code and used to identify atmospheric effects on the seasonal electricity output
- The absorption in two types of silicon solar cell (Al-BSF and Heterojucntion) was calculated from the UV to mid-IR, enabling sub-gap losses to be determined and the thermal emissivity
- The absorption in each layer of a perovskite/silicon tandem cell was calculated using RayFlare

Capabilities and facilities

- The code runs on standard desktop PCs using the Python3 language
- The code is under active development as an open-source project with international partners and users

Our partners

- Imperial College London
- IQE PLC
- Naked Energy Ltd

- US Airforce
- US Naval Research Laboratories