Hot Carrier Solar Cells

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Background

- Solar Cells are a technology to extract energy from light
- Higher energy efficiencies (or reduced prices) can make them more market competitive
- They are a major area of research in condensed matter physics
- They are a special type of PN (positive-negative) junction

Current State

- Solar cells efficiencies are currently stuck at the Shockly-Queisser limit, which is about 33% (achieved with a band gap of 1.4 eV)
- This is primarily due to thermalization and lack of absorption

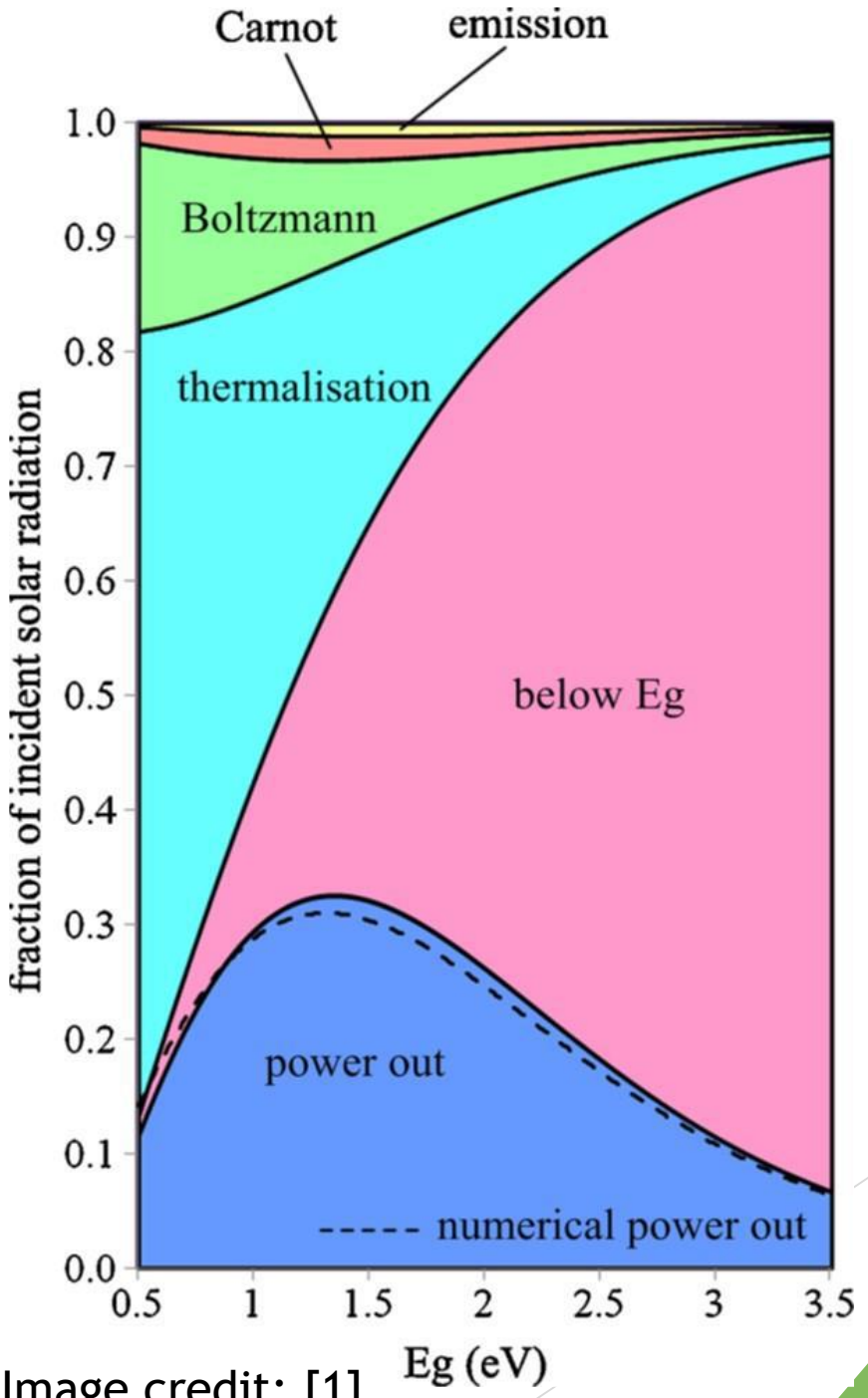

Image credit: [1]

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- There are many technologies (typically labelled as 3rd Generation solar cells) that have the potential to break this limit
- One of these is hot carrier solar cells, which seek to reduce thermalization losses, allowing for 85% efficiency in some cases
- Effectively, hot carrier solar cells “operate” at above their band gap, enabling the elimination of thermalization losses

Conclusion

- Solar cells are an important technology for the future of energy creation
- The current “generation” of cells cannot break the Shockly-Queisser limit of 33% efficiency
- Hot carrier solar cells are a potential technique to make cells of greater efficiency (or of reduced price) that could make solar cells market competitive

Sources

- [1] H. Esmaielpour. (2018) *Type-II Quantum Well Hot Carrier Solar Cells*. University of Oklahoma, Norman, Oklahoma.