How to quantify the efficiency potential of neat perovskite films: Perovskite semiconductors with an implied efficiency exceeding 28%

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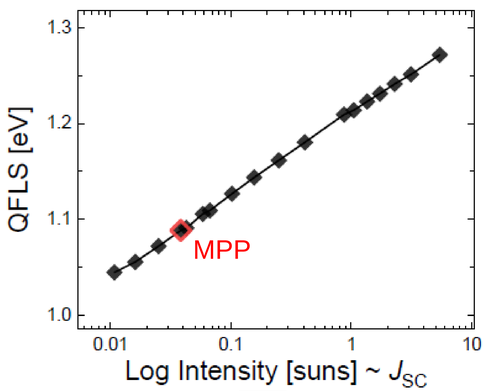
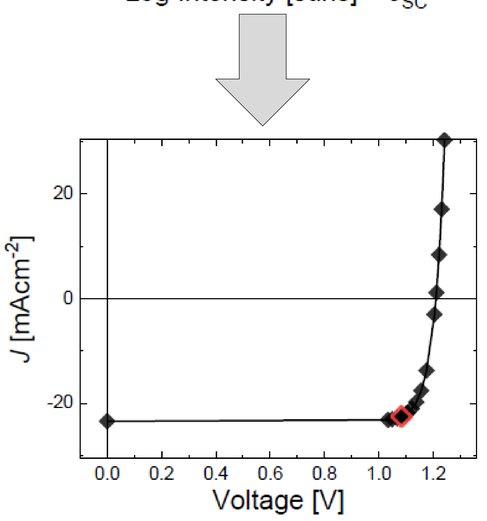
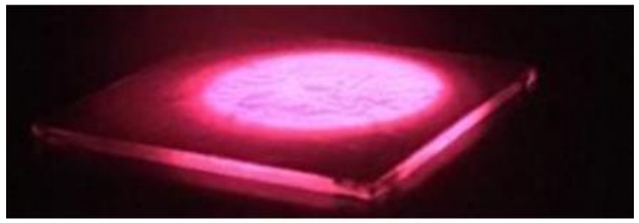
Methodology

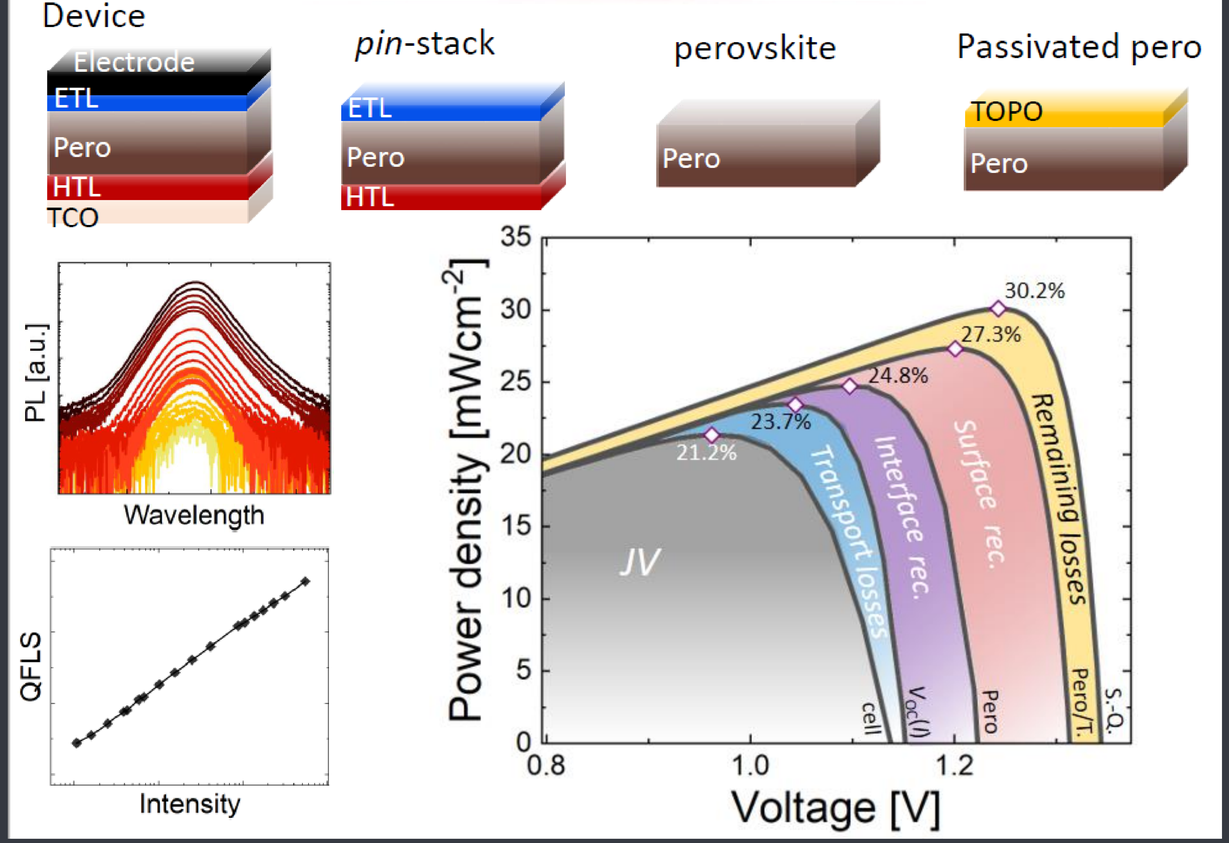
- Intensity-dependent QFLS measured on:
  - neat material on glass substrate
  - Stack (ETL/Pero/HTL)
  - Full device
- Assumption: EQE = 95%





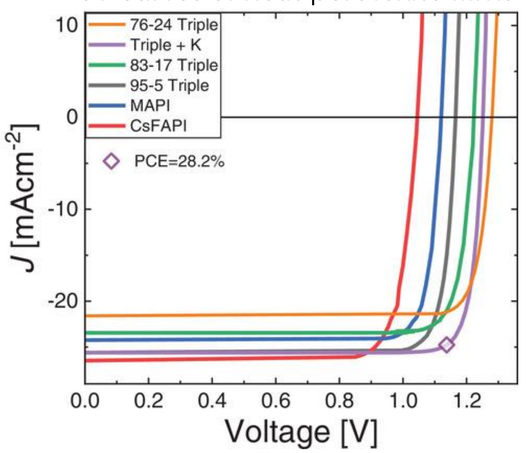
Intensity-dependent PL measurements reveal the contribution of **bulk, interface and surface recombination losses** in perovskite solar cells.



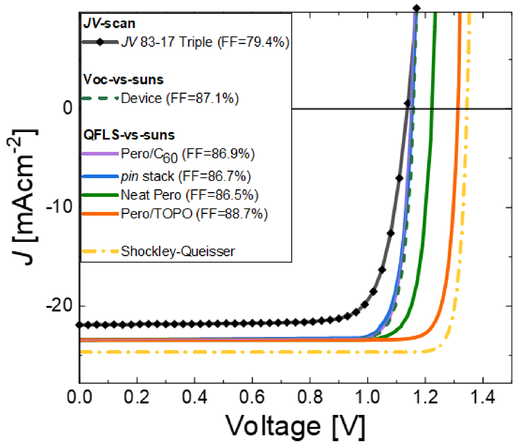


Results

JV curves of neat perovskite films



- Quantification of potential PCE, J_{SC}, V_{OC} and FF from neat perovskite films: Triple + K: pPCE=28.2 %



- Here: efficiency of 3Cat pero/C_{60} junction nearly identical to *pin*-stack on glass and complete cell from Suns-V_{OC}, but lower pPCE than neat material (24.8 %)
- Therefore: efficiency limited by interfacial recombination, in particular at C_{60} interface

Conclusions

- Intensity-dependent QFLS measurement is convenient method to quantify the potential solar cell parameters of a material or stack
- Method to determine most effective passivation strategy
- Potential PCE of K-passivated triple-cation perovskite films quantified to be 28.2%

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