**PYPVCELL – OPEN-SOURCED SOLAR CELL MODELING TOOLKIT IN PYTHON LANGUAGE**

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**Abstract**

We announced an open-source solar cell modeling and analysis toolkit written in Python. It is designed to be user-friendly, extensible and robust. This library contains a wide range of functions to do the heavy-lifting, error-prone jobs of modeling multi-junction solar cells, such as unit conversions and arithmetic operations of spectrum data, absorption-emission reciprocity or solving the I-Vs of multi-junction cells. In other words, Pypcvel is like “LEGO” that provides easy-to-use components allowing the users to rapidly adapt and build their own models. Source codes, detailed documentation and examples can be downloaded and found in https://kanhua.github.io/pypvcell.

**Introduction**

Modeling solar cells is an important part in designing and optimizing solar cell structure. Despite of the popularity of the modeling software such as PC1D and its descendant \([1][2]\), these software packages lack flexibility to custom or adjust the model to meet the unique requirements of individual research projects. Pypcvel was thus designed and implemented to fulfill this need. Pypcvel is written in Python, a general-purpose programming language that recently become very popular in scientific computing. Implementing the solar cell modeling library in Python also makes it easy to streamline the energy yield prediction with PVLIB-Python\([3]\) or other scientific computing packages in python.

**Implementation of Pypcvel**

The architecture of Pypcvel is illustrated in Figure 1. Pypcvel focuses on the simulation of the solar cell. A rich set of functions that perform the operations related to solar cells, including optics, photogeneration and carrier recombination. Pypcvel also provides various solar cell models that further wrap these functions into various solar cell models. Figure 2 demonstrates an example of using the analytical drift-diffusion model to simulate the quantum efficiencies of a III-V triple junction cell. Apart from these core functions of physical model simulation, Pypcvel also provides some utility functions to handle spectrum data and easy access of third-party model such as SMARTS\([4]\).

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**References**