In-situ ultrafast photovoltaic spectrometer (*in-situ* UPVS)

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Goal: Develop a spectrometer to test ultrafast photocurrent *in-situ* solar cells, with sub-5 picosecond (ps) time resolution (One ps is one trillionth second). Apply this transformational spectrometer to PV R&D, and devices and materials research in national labs and universities.

Major challenge

One major challenge in the photovoltaic characterization field is to break two bottlenecks:

- **to test solar cells *in-situ* by collecting photocurrent rather than PV materials only**
- **a couple-ps time resolution to capture a complete carrier dynamics with faster time resolution**

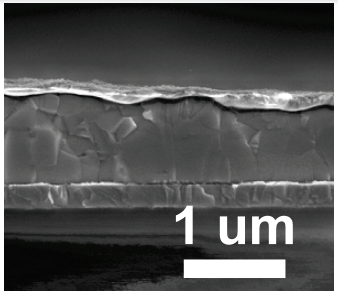
Our unique and transformational approach

- **Integrate a high-speed transmission line waveguide with a photoconductive switch, leading to a sub-5 ps time resolution.**
- **The in-situ UPVS can be applied to all PV technologies as well as device and materials research groups in national labs and universities.**

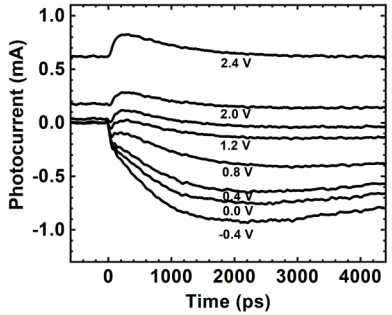
Proposed goals and milestones

SET!	To achieve sub-20 picosecond time-resolution
GO!	Demonstrate general application to all architecture devices
1-YEAR	To achieve a compact and portable UPVS instrument

Preliminary ultrafast photocurrent demonstration from *in-situ* UPVS



A perovskite solar cell



Ultrafast photocurrent measurements

UPVS specifications:

- **temperature (5 to 500 Kelvin)**
- **wavelength range (400 to 1100 nm)**
- **voltage bias (– 200 to + 200 volts)**
- **laser illumination from either bottom or top contact**

References

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