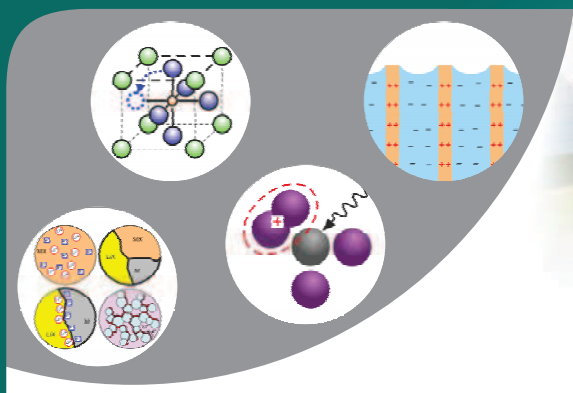

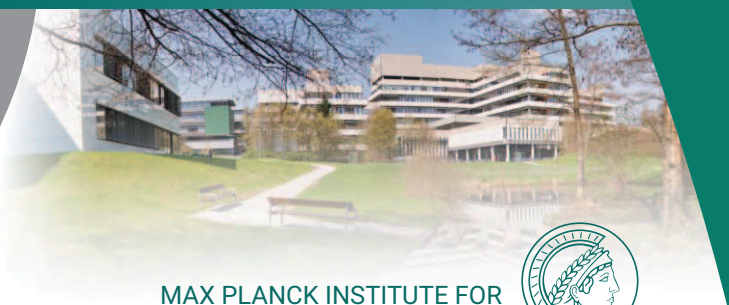

MAX PLANCK INSTITUTE FOR
SOLID STATE RESEARCH

Special Online Colloquium Series "Future of Electrochemistry"

November 9, 2020 • 4:30 p.m.

The scientific talk will be broadcasted via **ZOOM**. You will receive the login data by email.

The Versatility of Perovskite Materials for Optoelectronics

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Perovskite solar cells (PSCs) have created much excitement in the past years and attract spotlight attention. This talk will provide an overview of the reasons for this development highlighting the historic development as well as the specific material properties that make perovskites so attractive for the research community [1–3].

The current challenges are exemplified using a high-performance model system for PSCs (multication Rb, Cs, methylammonium (MA), formamidinium (FA) perovskites) [2,3]. The triple cation (Cs, MA, FA) achieves power conversion efficiencies (PCEs) close to 21% due to suppressed phase impurities. This results in more robust materials enabling breakthrough reproducibility.

Through multication engineering, the usually not-considered Rb can be studied (unsuited as single-cation perovskite) [4]. This results in a stabilized efficiency of 21.6% with one of the smallest differences between bandgap and voltage ever measured for any PV material. Polymer-coated cells maintained 95% of their initial performance at elevated temperature for 500 hours under working conditions, a crucial step towards industrialisation of PSCs.

To explore the theme of multicomponent perovskites further, molecular cations were re-evaluated using a globularity factor. With this, we calculated that ethylammonium (EA) has been misclassified as too large. Using the multication strategy, we studied an EA-containing compound that yielded a high open-circuit voltage of 1.59 V. Moreover, using EA, we demonstrate a continuous fine-tuning for perovskites in the "green gap" which is relevant for lasers and display technology [5].

The last part elaborates on a roadmap on how to extend the multication to multicomponent engineering providing a series of new compounds that are highly relevant candidates for the coming years, also in areas beyond photovoltaics, for example for medical scintillation detectors [5,6].

[1] N. Jeon *et al.*, Nature (2015)
[2] J. Lee *et al.*, Advanced Energy Materials (2015)
[3] D. McMeekin *et al.*, Science (2016)
[4] M. Saliba *et al.*, Incorporation of rubidium cations into perovskite solar cells improves photovoltaic performance, Science (2016)
[5] S. Gholipour *et al.*, Globularity-Selected Large Molecules for a New Generation of Multication Perovskites, Advanced Materials (2017)
[6] S. Turren-Cruz *et al.*, Methylammonium-free, high-performance and stable perovskite solar cells on a planar architecture, Science (2018)

All members of the institute are cordially invited.

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