7th Mar 2018, Sede Boqer, Israel

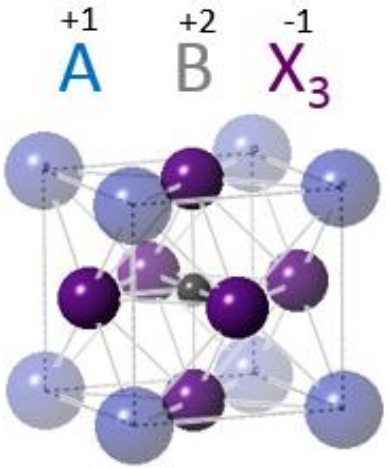
Ionic (in)homogeneity in metal-halide perovskites

Eva L. Unger[1,2], Katrin Hirselandt[1], Aniela Czudek[1], Carolin Rehermann[1], Klara Suchan[2], Justus Just[2], Aboma Merdasa[1,2], Ivan Scheblykin[2]

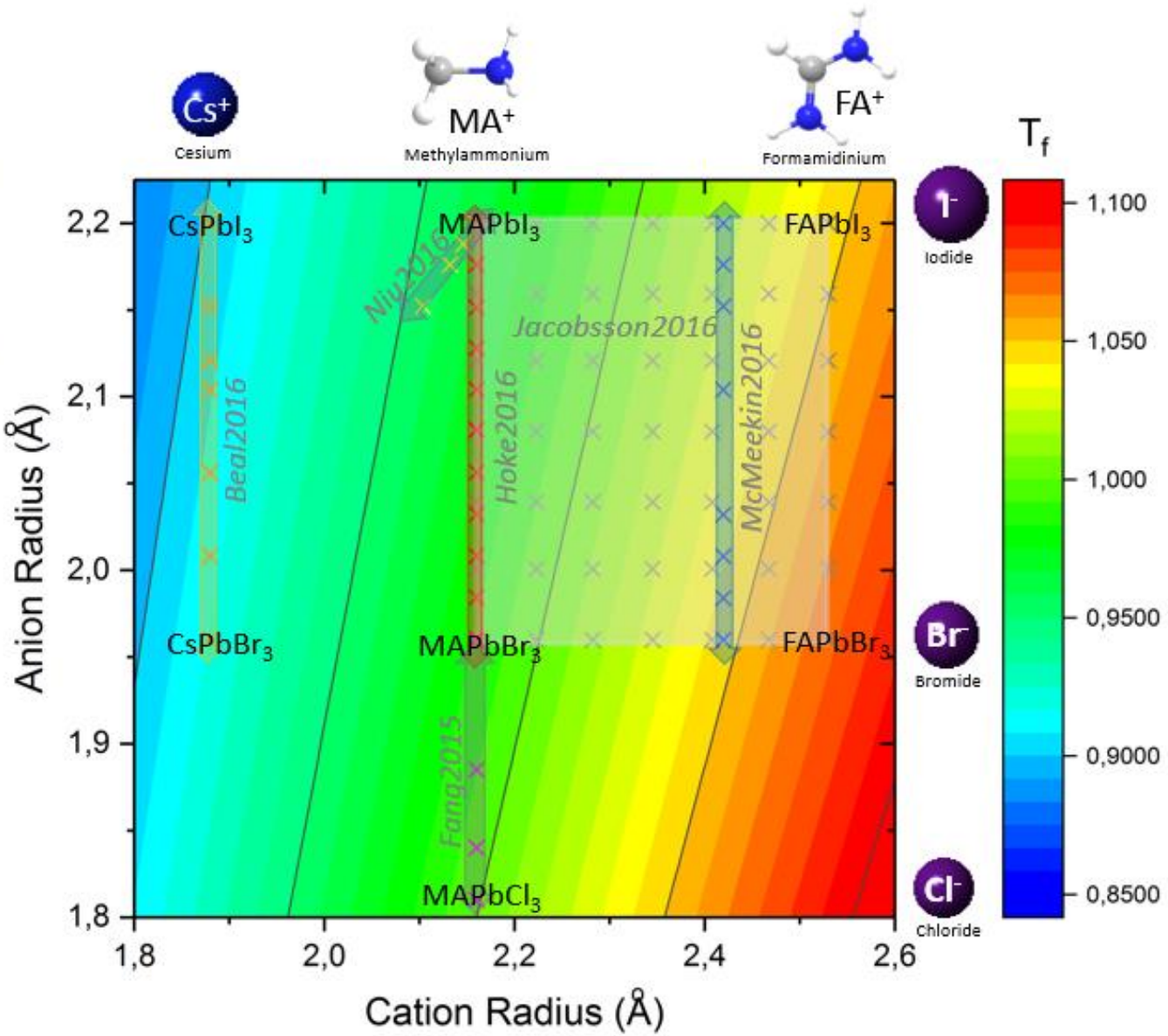
[1]HELMHOLTZ ZENTRUM BERLIN FÜR MATERIALIEN UND ENERGIE, BERLIN, GERMANY

[2]DEPARTMENT OF CHEMISTRY, LUNDS UNIVERSITET, LUND, SWEDEN

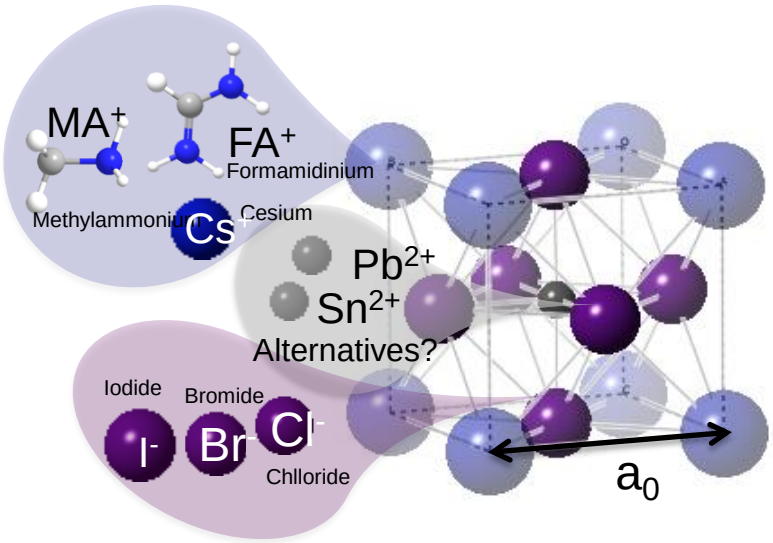
PEROVSKITE ALLOY PARAMETER SPACE



Ion	Radius (A)
Rb^{+}	1,72
Cs^{+}	1,88
MA^{+}	2,16
FA^{+}	2,53
Pb^{2+}	1,19 (*1,0**)
Sn^{2+}	1,10
Sr^{2+}	1,19
Cl^{-}	1,81
Br^{-}	1,96
I^{-}	2,20

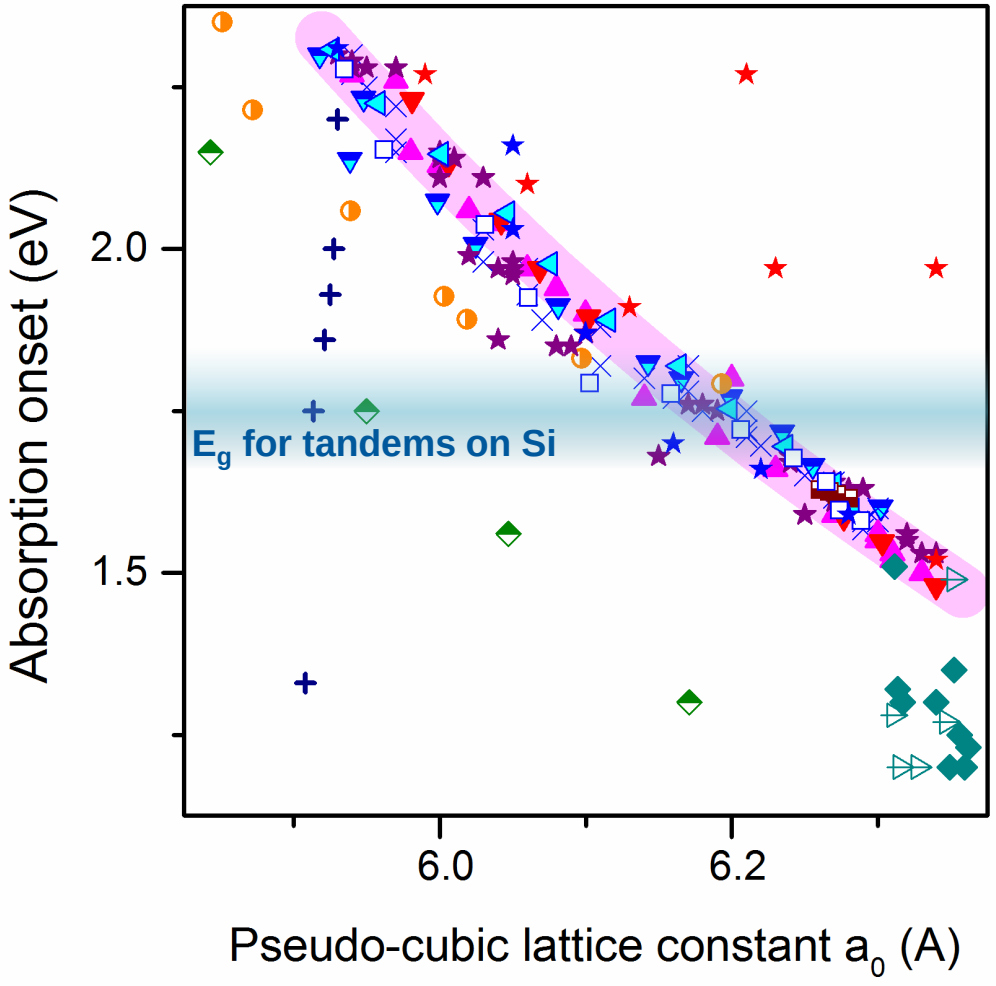


BANDGAP TUNABILITY: DATA DIGGING



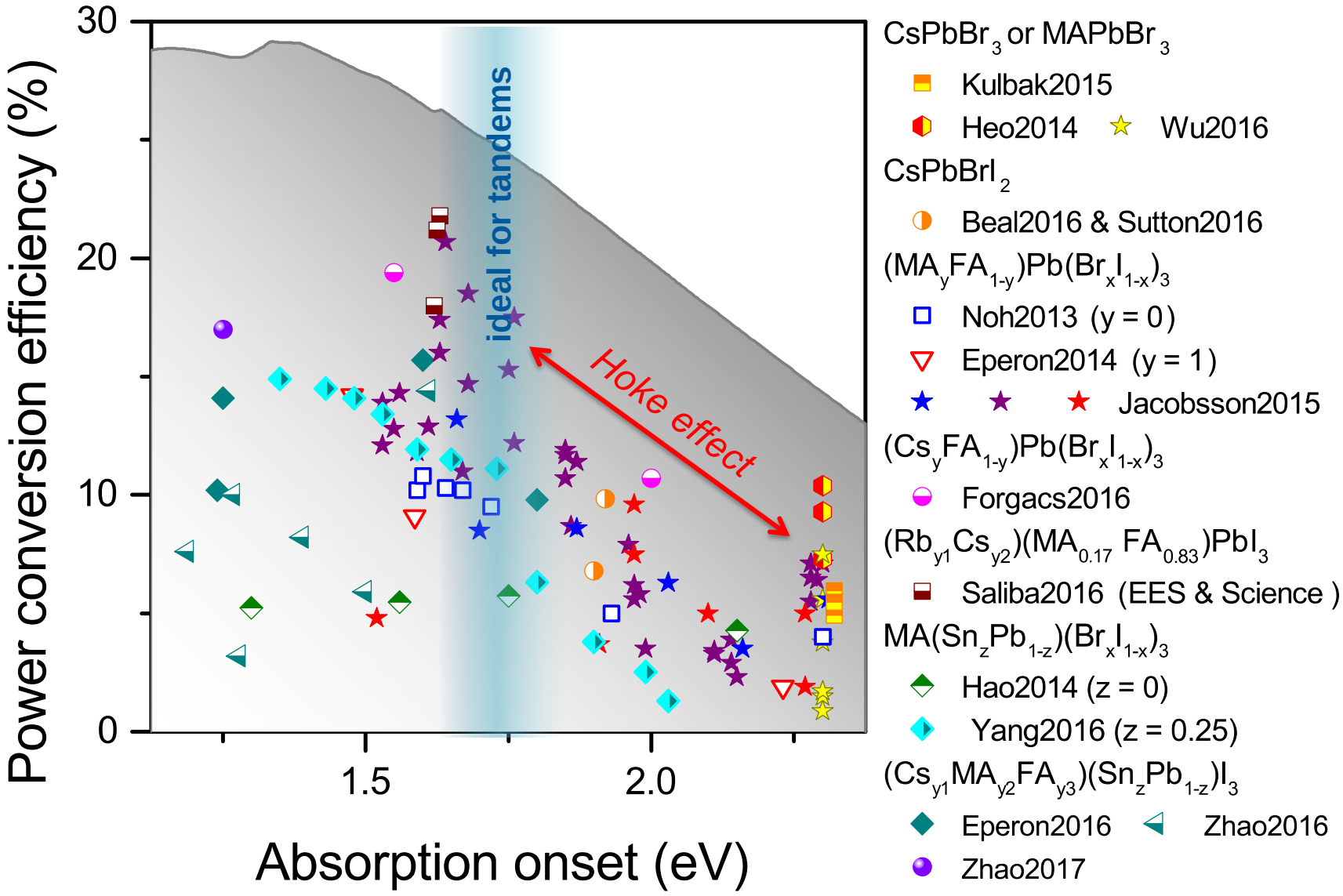
Experimental data sets from literature on cation/anion alloys.

Pb-based perovskites: Absorption onset depends on lattice parameter



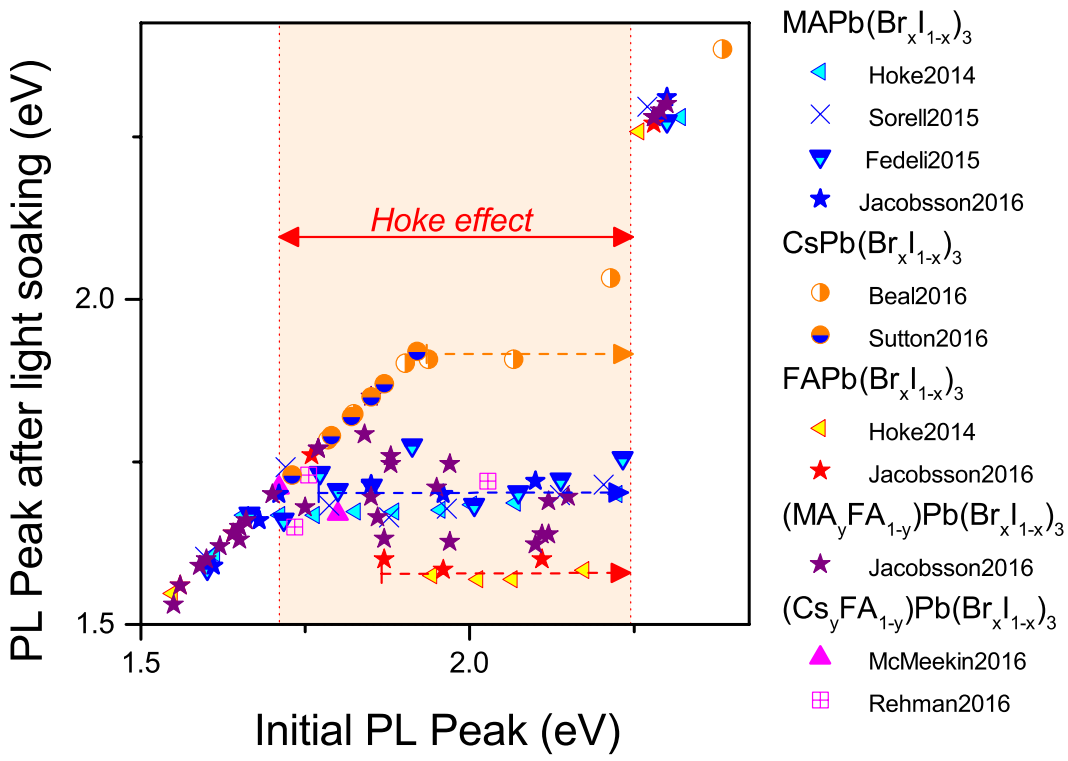
Unger et al., J. Mater. Chem. A, 5, 11401 (2017)

BANDGAP TUNABILITY: DATA DIGGING



Unger et al., J. Mater. Chem. A, 5, 11401 (2017)

PHOTO-INDUCED PHASE SEGREGATION

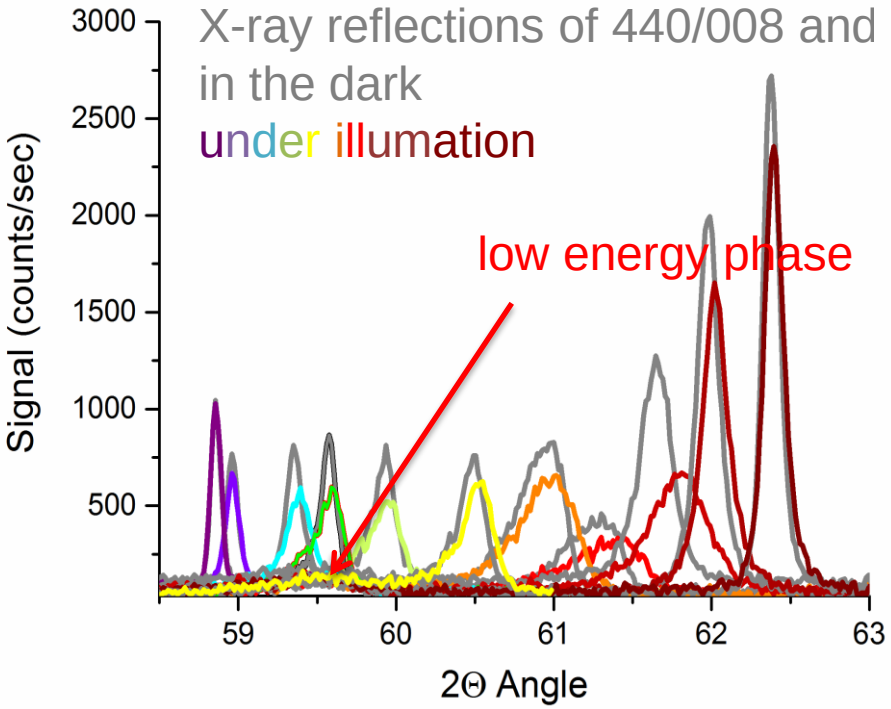


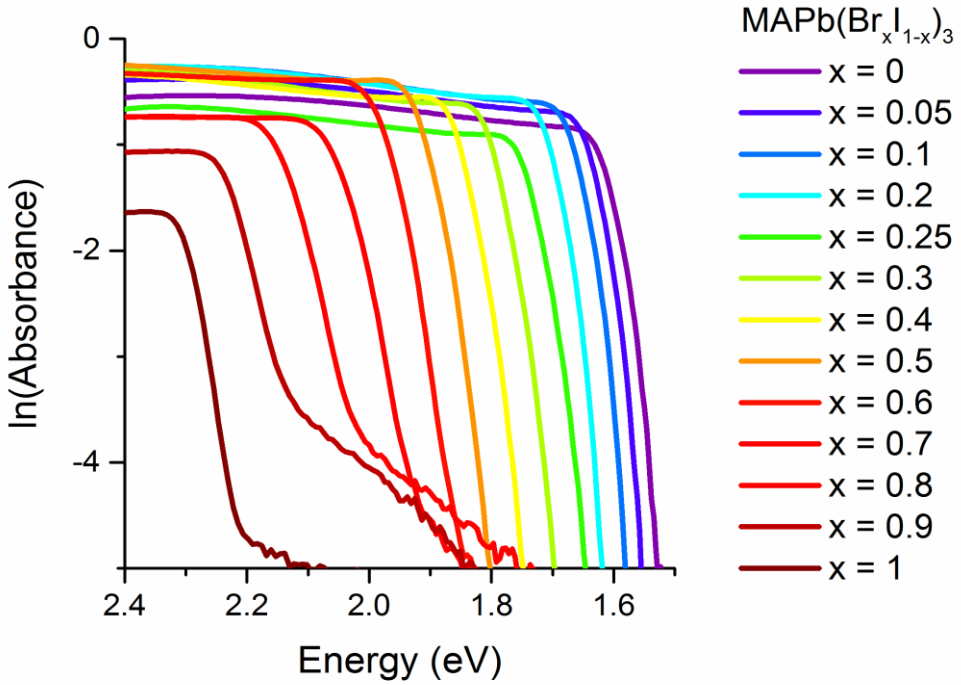
- Dip in performance correlates with onset of low-energy phase appearance
- Understand origin of low energy sites

Hoke et al., Chem. Sci. 6 (1), 613-617 (2014)

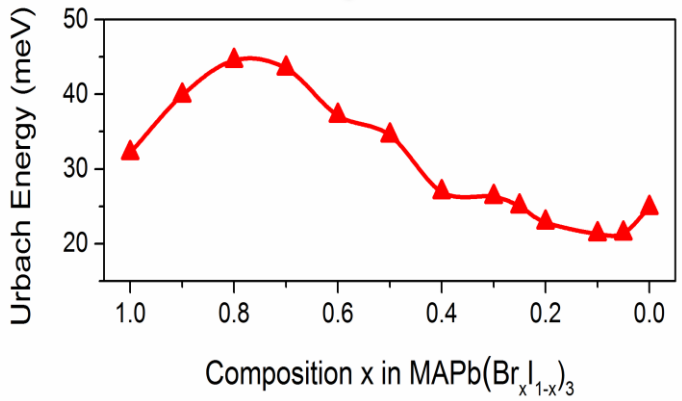
Unger et al., J. Mater. Chem. A, 5, 11401 (2017)

IN-SITU XRD & URBACH ENERGY





Urbach Energy



There is apparently a low energy phase in our samples as prepared.

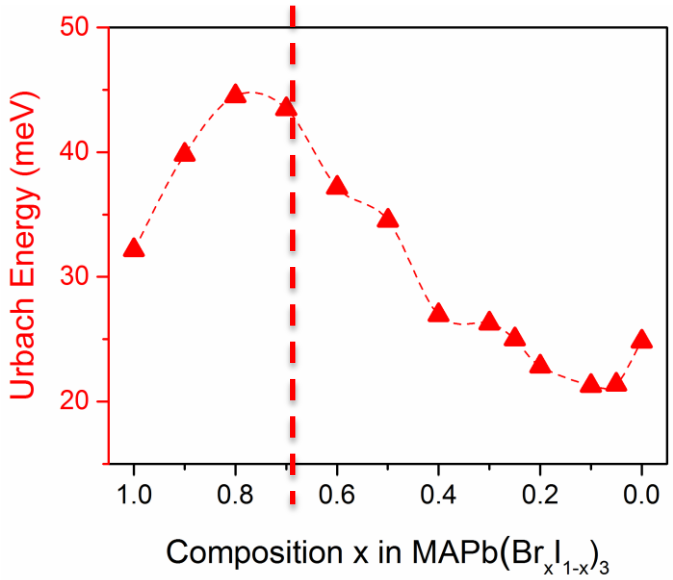
Unger et al. (manuscript in preparation)

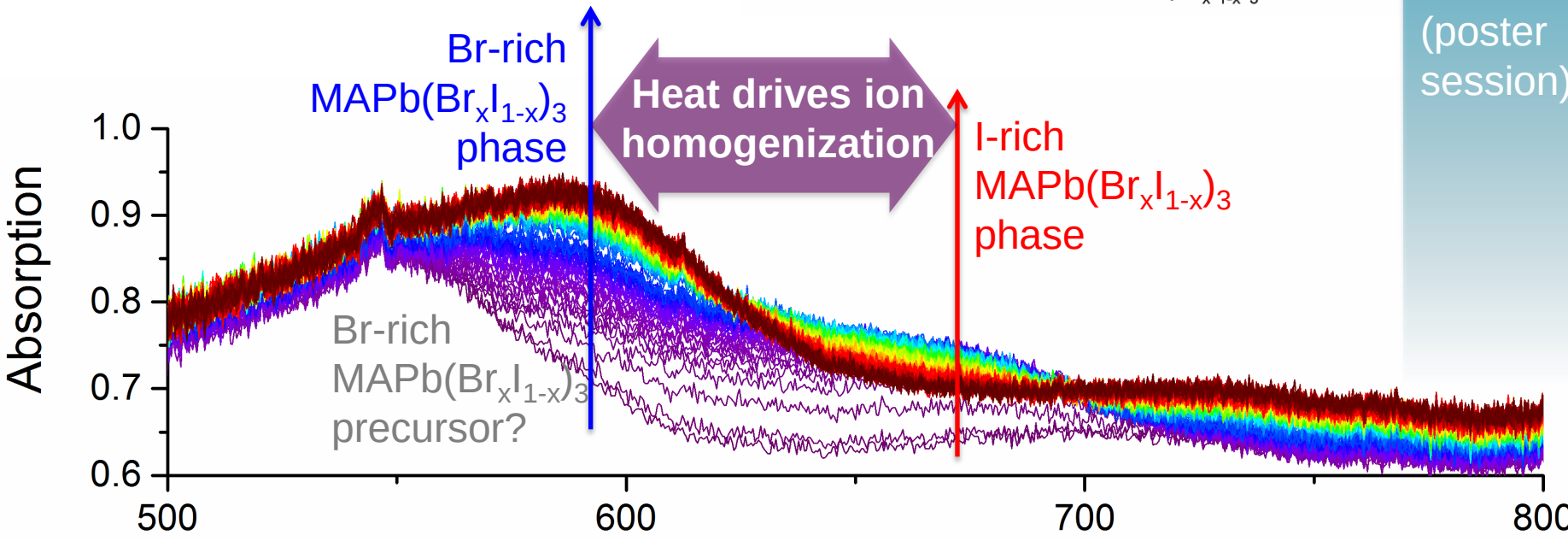
UNDERSTANDING GROWTH

Carolin Rehermann

Formation studies of perovskite alloys

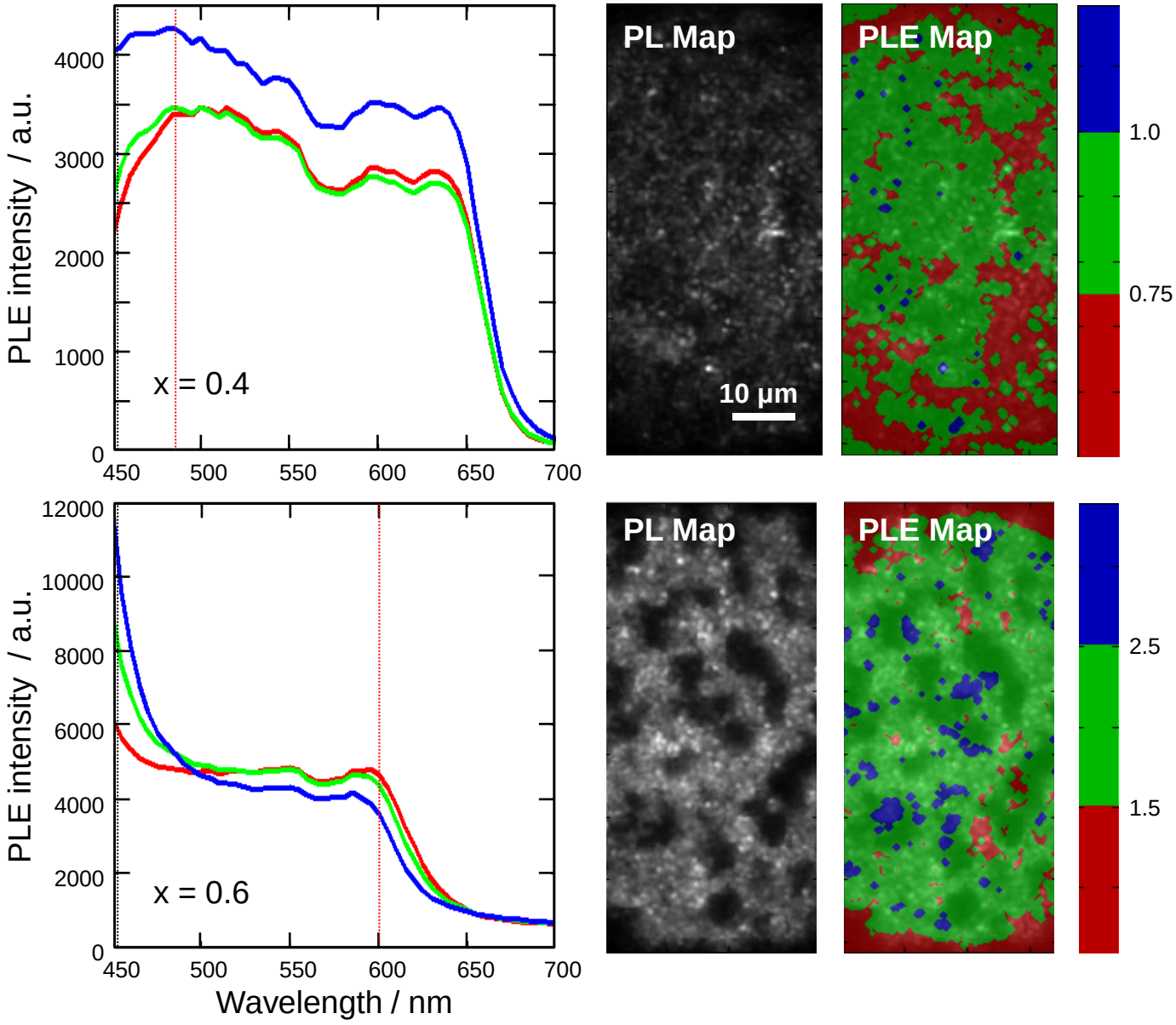
(poster session)





Unger et al. (manuscript in preparation)

PHOTO-INDUCED PHASE SEGREGATION



Aboma Merdasa

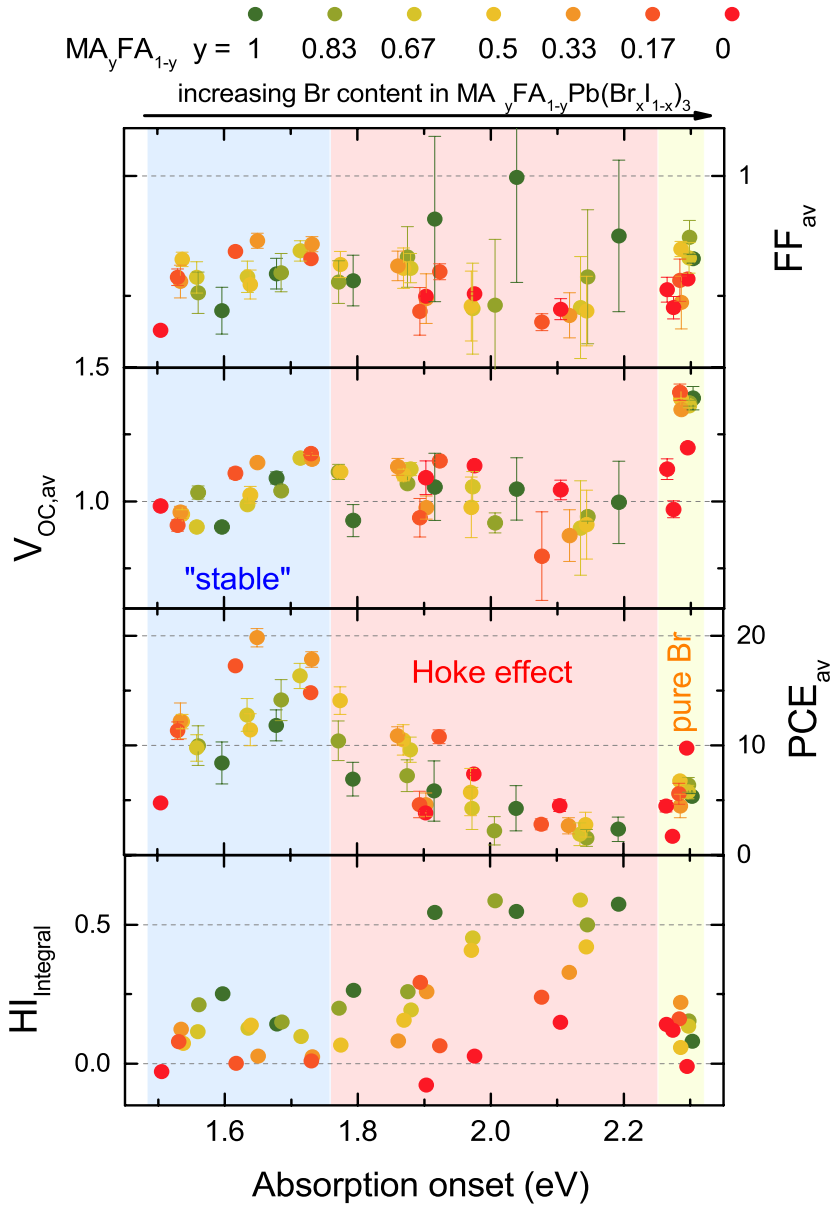
Photo-luminescence excitation Microscopy

Study compositional Inhomogeneity

In-situ studies of phase-segregation & Degradation

(poster session)

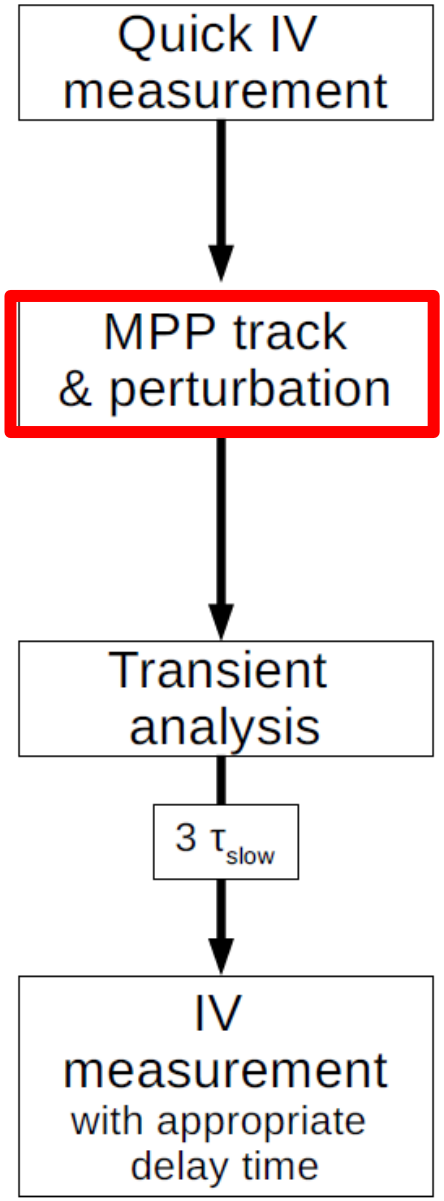
BANDGAP TUNABILITY: DATA DIGGING

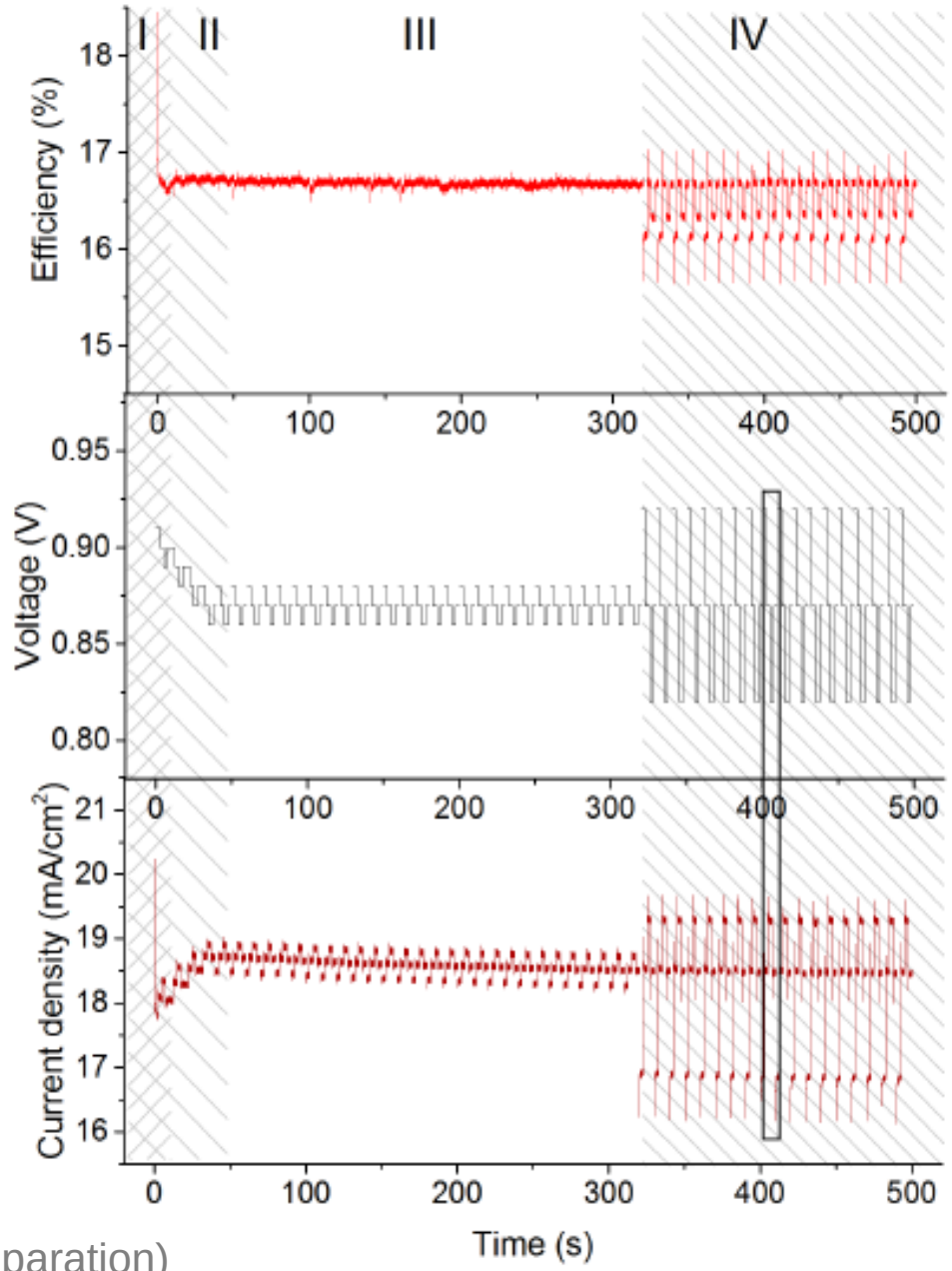


$$HI_4 = \frac{\int_{V_{OC}}^{0} J_R - \int_{0}^{V_{OC}} J_F}{\int_{V_{OC}}^{0} J_R}$$

Jacobsson et al., En. Env. Sci. (2016)

DYNAMIC MAXIMUM POWER POINT TRACKING





Czudek et al. (manuscript in preparation)

Aniela Czudek

Dynamic maximum power point measurements and hysteresis analysis

(see poster K. Hirselandt

DYNAMIC MAXIMUM POWER POINT TRACKING

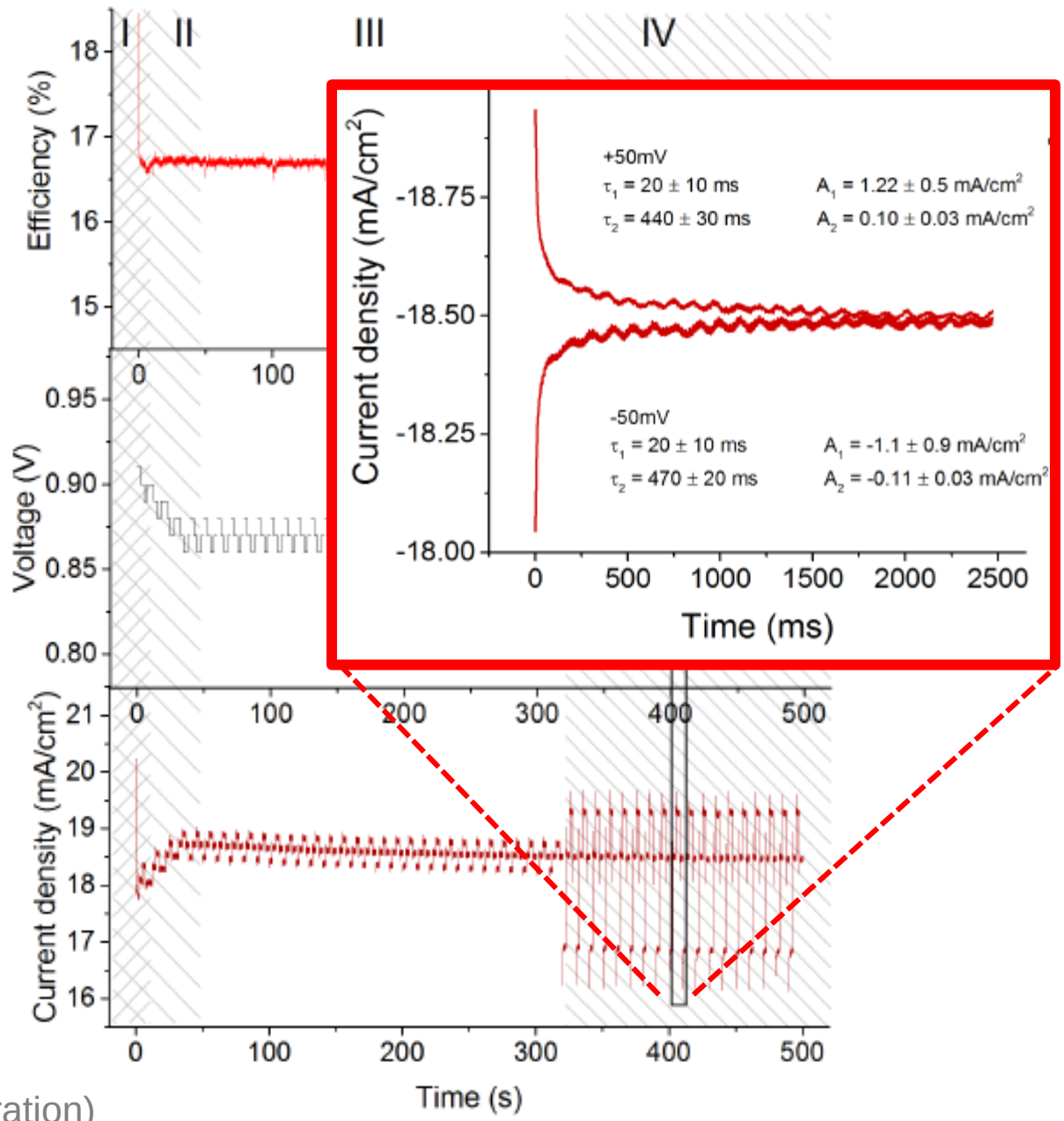
Quick IV measurement

MPP track & perturbation

Transient analysis

$3\ \tau_{slow}$ ca 1.5 s

IV measurement with appropriate delay time



Czudek et al. (manuscript in preparation)

DYNAMIC MAXIMUM POWER POINT TRACKING

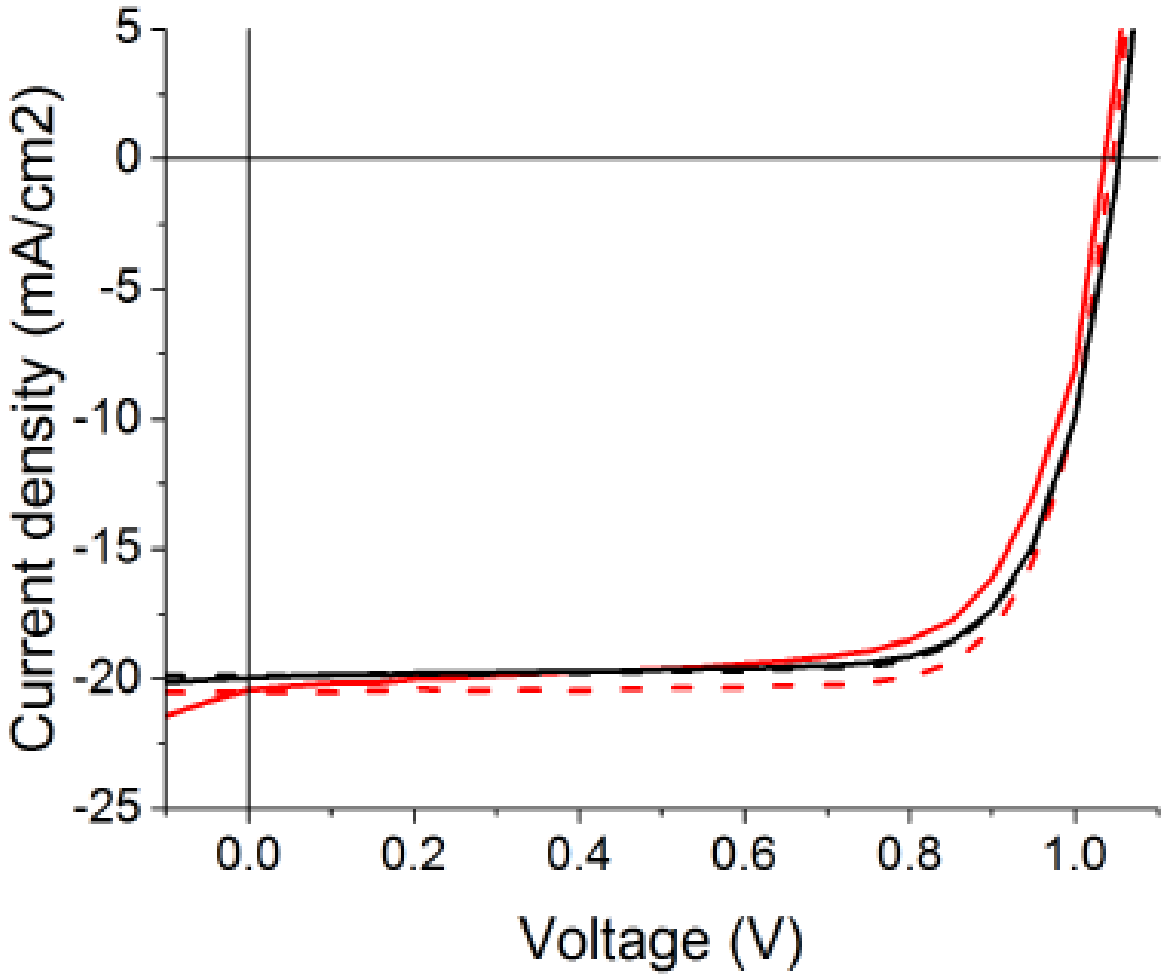
Quick IV measurement

MPP track & perturbation

Transient analysis

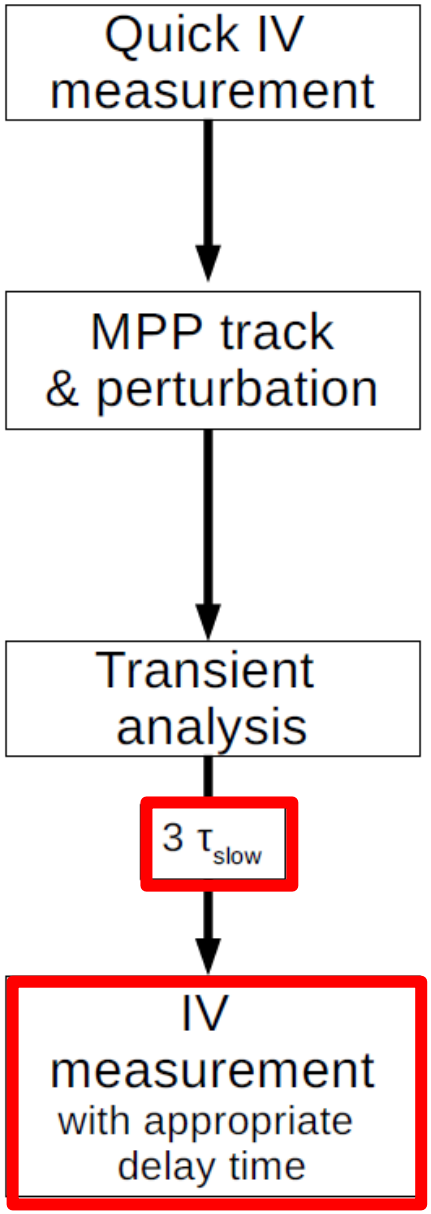
$3\ \tau_{slow}$ ca 1.5 s

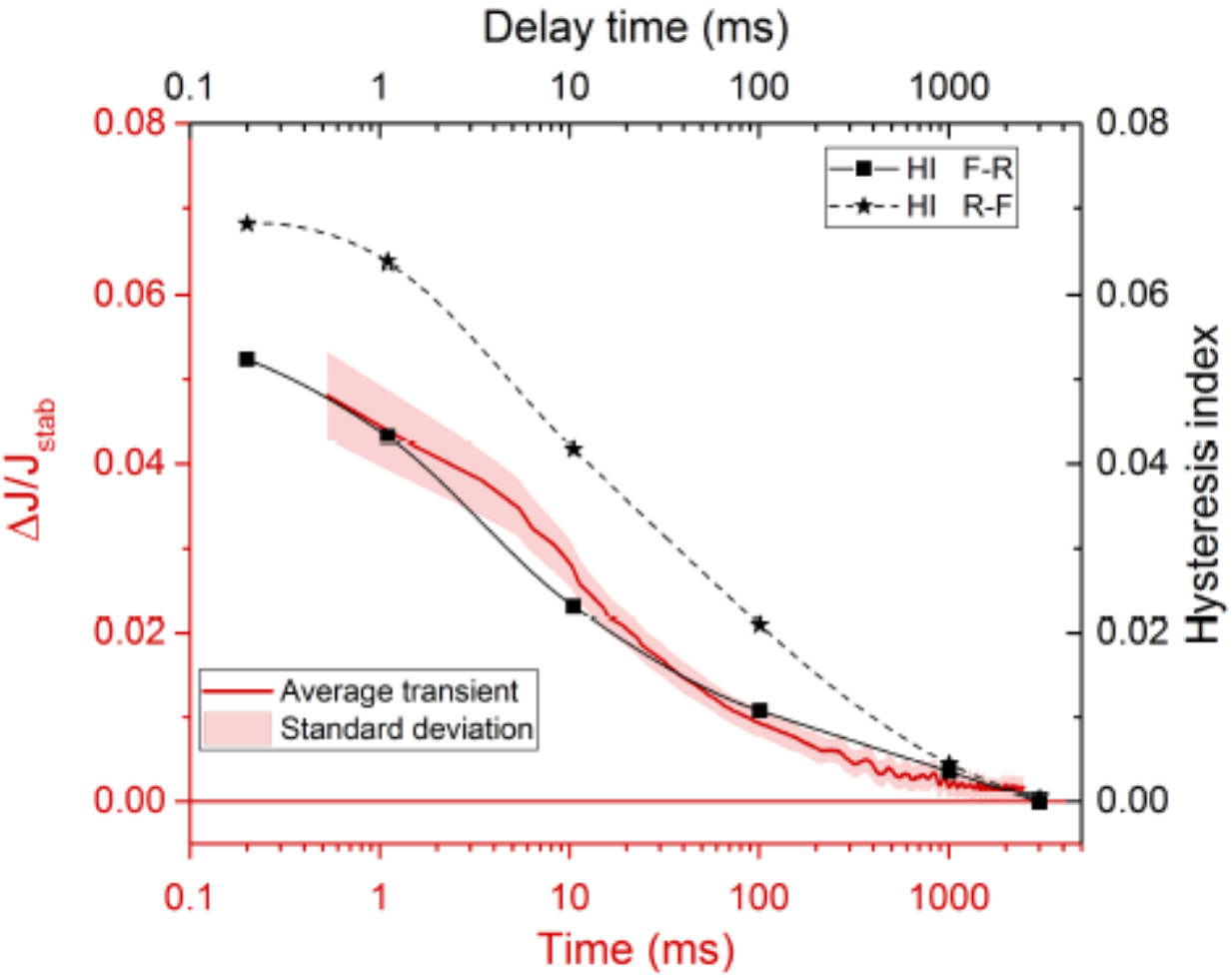
IV measurement with appropriate delay time



Czudek et al. (manuscript in preparation), K. Hirselandt (poster session)

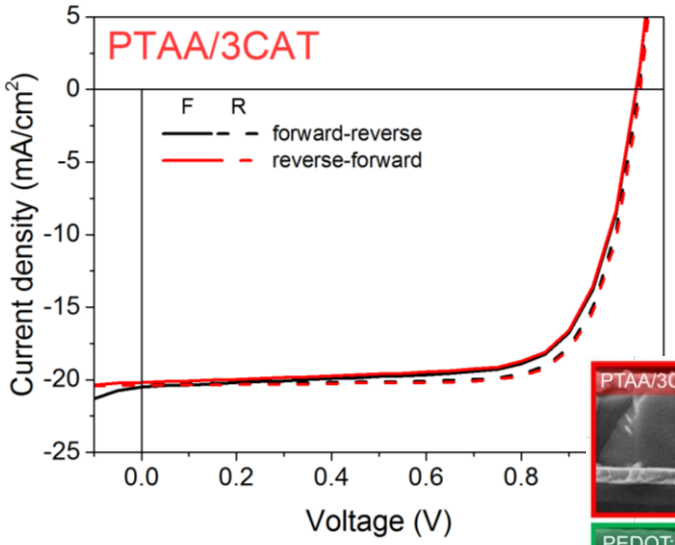
DYNAMIC MAXIMUM POWER POINT TRACKING

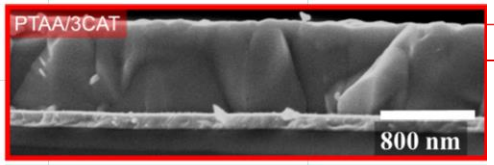


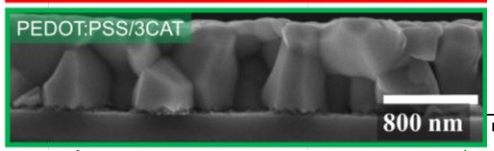


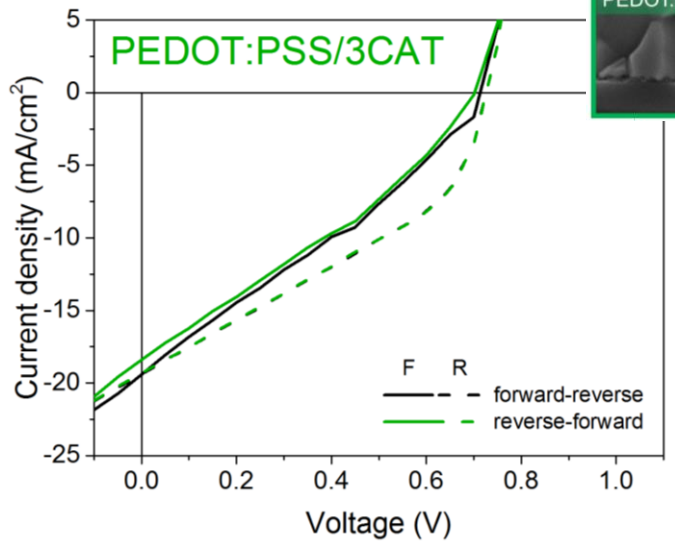
Czudek et al. (manuscript in preparation), K. Hirselandt (poster session)

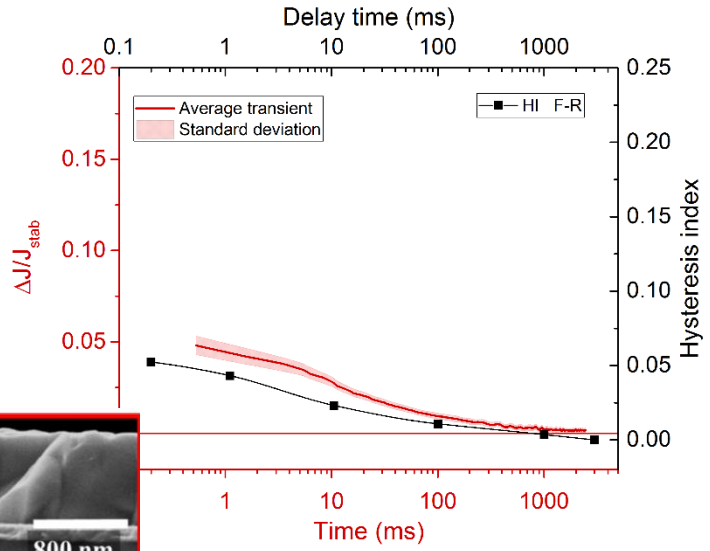
TRANSIENT RESPONSE OF DEVICES

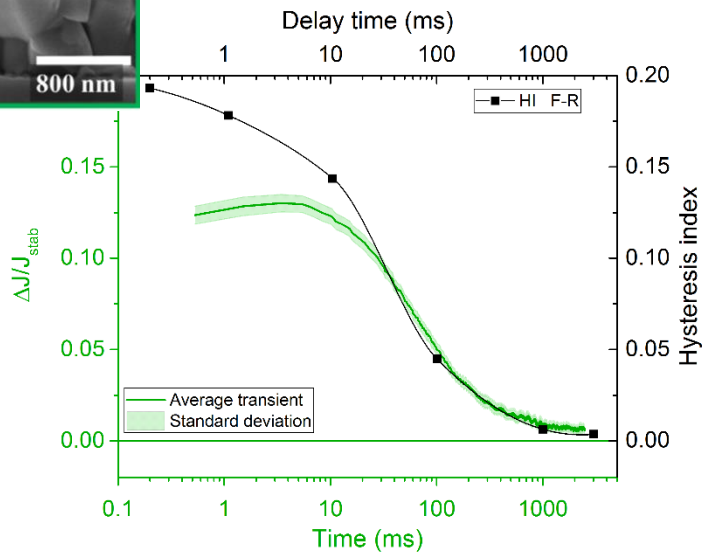












Katrin Hirselandt

poster session

Reproducibility and transient response of inverted Perovskite devices

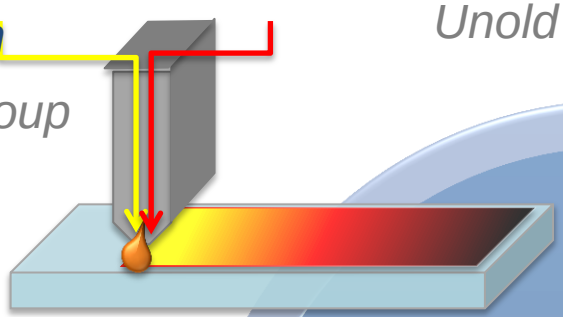
K. Hirselandt (poster session)

THANKS TO…

Carolin Rehermann
Abou-Ras group

Aboma Merdasa
Unold group

Klara Suchan (LU)
Justus Just (LU)
Ivan Scheblykin (LU)

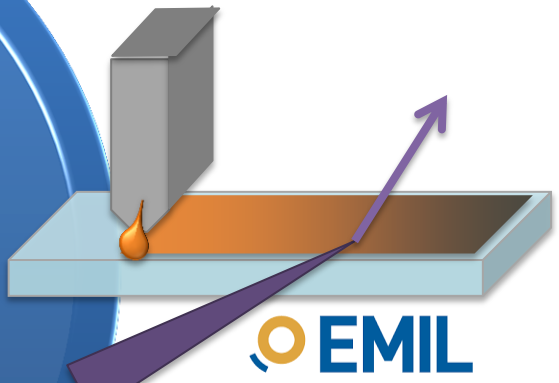


Hampus Näsström

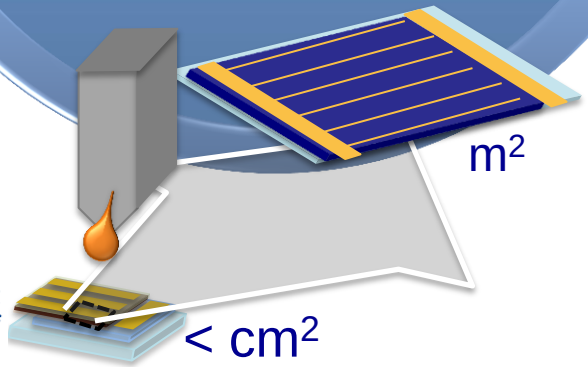
Katrin Hirselandt
Steffen Braunger

Aniela Czudek

Hagen Heinz



Bär group



Emil List-Kratochvil

Steve Albrecht
Antonio Abate
Bernd Rech

Hybrid Integrated Systems for Conversion of Solar Energy

HI-SCORE

Prof. R. van de Krol 

Dr. PD. D. Abou-Ras 

Dr. E. Unger (YIG) 

Prof. N. Koch 

Prof. M. Bär 

Prof. S. Schorr & Dr. T. Unold 

Dr. A. Abate (YIG) 

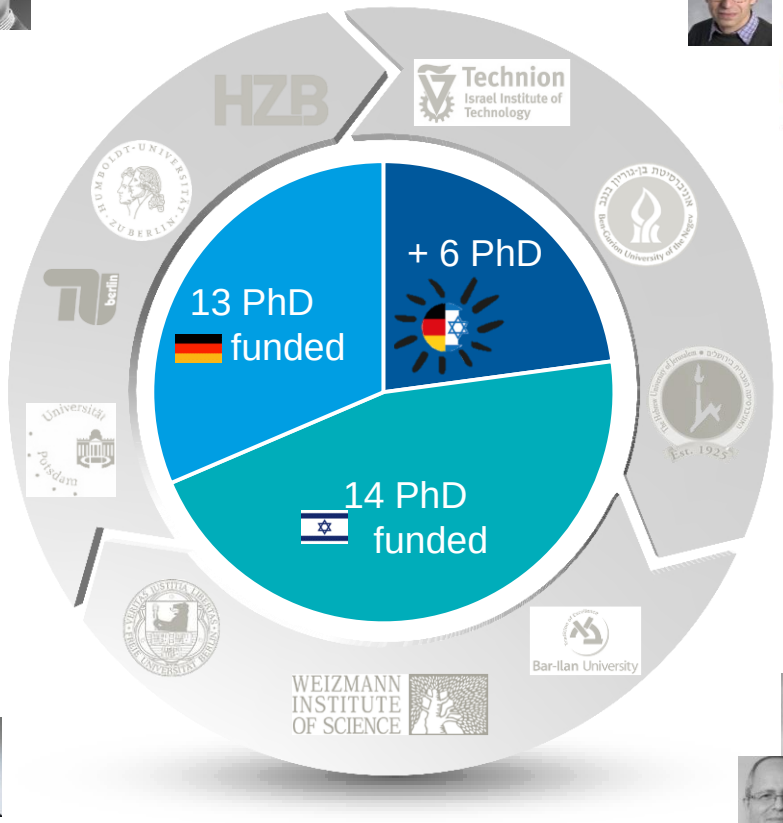
Prof. N. Nickel

Prof. K. Lips 

Dr. S. Albrecht (YIG) 

Prof. D. Neher

Prof. B. Rech



Prof. D. Cahen, Prof G. Hodes 

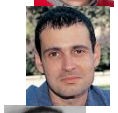
Dr. D. Oron Dr. O. Yaffe

Dr. I. Visoly Fisher 

Prof. L. Etgar 

Prof. A. Zaban 

Prof. E. A. Katz 

Prof. L. Kronik 

Prof. O. Millo 

Prof. M. Shalom 

Prof. A. Blank 

Prof. A. Rothschild 

There will be 6-8 new PhD positions in Berlin with placement in Israel tba soon!

HySPRINT Perovskite Lab

- Corelab (external user access)
- Scalable deposition techniques up to 100 cm^2
- Collaborations with Industry and Academia