This is a readme-file for the dataset to the article "*Lead-Free Perovskite-Inspired Absorbers for Indoor Photovoltaics*", published in *Advanced Energy Materials*, article number: 2002761, DOI: ﻿10.1002/aenm.202002761

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The dataset contains the files used for the figures the main text and Supporting Information.

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ARTICLE FIGURES:

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**Fig1b:**

General information:

X-ray diffraction patterns of BiOI and Cs-Sb-I-Cl thin films

Measured by: BiOI film measured by Tahmida Huq, University of Cambridge, UK, Cs-Sb-Cl-I films were measured by Yueheng Peng, Soochow University, China.

Methodological information: The experimental details are given in the Article's Experimental section

Data and file overview: XRD files are in ASCII format which can be opened with Excel/Origin.

Filenames: BiOI\_XRD.ASC and Cs-Sb-I-Cl\_XRD.ASC,

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**Fig1d**

General information: Absorption coefficient calculated from transmittance and reflectance measurements from UV-visible spectrophotometry.

Measured by: BiOI – taken from Ref. 1

 Cs-Sb-I-Cl – Robert Jagt, University of Cambridge, UK

Methodological information: The experimental details are given in the Article's Experimental section.

Data and file overview:

BiOI absorption coefficient is saved as .ASCII and .txt formats which can be opened using Excel/Origin or on Notepad. Absorption coefficient of Cs-Sb-I-Cl is saved as .xlsx document.

Filename:

BiOI\_absorption\_coefficient.txt

BiOI\_absorption\_coefficient.asc

Cs-Sb-I-Cl absorption coefficient.xlsx

**Fig2c:**

General information:

The EQE spectra of BiOI and Cs-Sb-I-Cl along with the spectra of AM 1.5G, indoor fluorescent (FL) and white-light LED (WLED) sources.

Measured by: EQE of devices, along with the FL and WLED spectra are measured by Yueheng Peng, Soochow University. ASTMG173-03 was used to plot the AM 1.5G spectrum

Methodological information:

The experimental details are given in the Article's Experimental section.

Data and file overview:

EQE data for BiOI and Cs-Sb-I-Cl are in .ASCII format which can be opened using Excel/Origin. The spectra of different light sources are in a .txt format which can be opened with any text editor and/or Excel/Origin.

File name:

Figure 2c - BiOI\_EQE.ASC

Figure 2c – Cs-Sb-Cl-I\_EQE.ASC

ASTMG173-03.txt

FL\_power\_density\_Wmm2nm\_updated.txt

WLED\_power\_density\_Wm2nm\_updated.txt

**Fig2d:**

General information:

Current density vs. voltage plots of BiOI and Cs-Sb-I-Cl under FL illumination.

Measured by: Yueheng Peng, Soochow University, China

Methodological information:

The experimental details are given in the Article's Experimental section.

Data and file overview:

Current vs voltage characteristics are in .csv format and can be opened directly in Excel or imported into Origin.

File name:

Figure 2d – BiOI.csv

Figure 2d – CsSbClI.csv

**Fig2e:**

General information:

Current density vs. voltage plots of BiOI and Cs-Sb-I-Cl under AM 1.5G illumination.

Measured by: Yueheng Peng, Soochow University, China

Methodological information:

The experimental details are given in the Article's Experimental section.

Data and file overview:

Current vs voltage characteristics are in .csv format and can be opened directly in Excel or imported into Origin.

File name:

Figure 2e – BiOI.csv

Figure 2e – CsSbClI.csv

**Fig2f:**

General information:

Current density vs. voltage plots of BiOI and Cs-Sb-I-Cl under WLED illumination.

Measured by: Yueheng Peng, Soochow University, China

Methodological information:

The experimental details are given in the Article's Experimental section.

Data and file overview:

Current vs voltage characteristics are in .csv format and can be opened directly in Excel or imported into Origin.

File name:

Figure 2f – BiOI.csv

Figure 2f – CsSbClI.csv

**Fig3b:**

General information:

Voltage transfer characteristics and gain of CNT TFT inverter powered by indoor Cs-Sb-I-Cl solar cell.

Measured by: Luis Portilla, Soochow University, China

Methodological information:

The experimental details are given in the Article's Experimental section.

Data and file overview:

Voltage Transfer Characteristics and Gain data are saved in .csv format and can be opened directly in Excel or imported into Origin.

File name:

Figure 3b – Gain.csv

Figure 3b– VTC.csv

**Fig3c:**

General information:

Voltage transfer characteristics and gain of CNT TFT inverter powered by indoor BiOI solar cell.

Measured by: Luis Portilla, Soochow University, China

Methodological information:

The experimental details are given in the Article's Experimental section.

Data and file overview:

Voltage Transfer Characteristics and Gain data are saved in .csv format and can be opened directly in Excel or imported into Origin.

File name:

Figure 3c – Gain.csv

Figure 3c– VTC.csv

**Fig4a:**

General information:

Optical power dependence of open-circuit voltage of BiOI and Cs-Sb-I-Cl photovoltaics under monochromatic illumination.

Measured by: Yueheng Peng, Soochow University, China

Methodological information:

The experimental details are given in the Article's Experimental section.

Data and file overview:

Open-circuit voltage vs. illumination power density data for BiOI and Cs-Sb-I-Cl is in .csv format and can be opened directly in Excel or imported into Origin.

File name:

Figure 4a.csv

**Fig4b:**

General information:

Optical power dependence of short-circuit current density of BiOI and Cs-Sb-I-Cl photovoltaics under monochromatic illumination.

Measured by: Yueheng Peng, Soochow University, China

Methodological information:

The experimental details are given in the Article's Experimental section.

Data and file overview:

Short-circuit current vs. power data for BiOI and Cs-Sb-I-Cl is in .csv format and can be opened directly in Excel or imported into Origin.

File name:

Figure 4b.csv

**Fig4c:**

General information:

Optical power dependence of the fill factor of BiOI and Cs-Sb-I-Cl photovoltaics under monochromatic illumination.

Measured by: Yueheng Peng, Soochow University, China

Methodological information:

The experimental details are given in the Article's Experimental section.

Data and file overview:

Fill factor vs. power data for BiOI and Cs-Sb-I-Cl is in .csv format and can be opened directly in Excel or imported into Origin.

File name:

Figure 4c.csv

**Fig4d and Fig4e:**

General information:

Optical loss analysis in BiOI and Cs-Sb-I-Cl photovoltaics using transmittance, reflectance measurements of the device stacks.

Measured by: Cs-Sb-I-Cl device stack transmittance and reflectance measured by Jianjun Mei and Robert A. Jagt. Transmittance and reflectance of BiOI device stack taken from Ref. 1

Analysis by: Tahmida N. Huq, University of Cambridge, UK

Methodological information:

The experimental details are given in the Article's Experimental section.

Data and file overview:

All the raw transmittance and reflectance data are saved in a .csv format. The absorption coefficient of BIOI is a .txt format. The files can be opened in Excel or Origin. The data files can be run through with the equations described in Section 5 of SI in Ref.1, in either Matlab or Python to generate the plots shown in the Figures. The area under of each region corresponding to the losses in current density have been compiled in Table 2 in the main text.

File name:

BiOI reflectance.csv

BiOI\_absorption\_coefficient.txt

CsSbClI\_reflectance.csv

FTO\_alpha.csv

ITO\_alpha.csv

NiOI\_alpha.csv

TiO2\_alpha.csv

**Fig5:**

General information:

Measured absorption coefficients of all the compounds analyzed under the radiative limit and Spectroscopic Limited Maximum efficiency and AM 1.5G, FL and WLED spectra.

Analysed by: Tahmida N. Huq and Robert A. Jagt, University of Cambridge, UK

Methodological information:

The experimental details are given in the Article's Experimental section.

Data and file overview:

All the absorption coefficient data are saved in either .txt or .ASC format and can be opened in Notepad, Excel or Origin. The efficiency limits can be achieved by running these absorption coefficients with the equations described in the SI.

File name:

Alpha\_Ag2Bii5.txt

Alpha\_AgBiI4.txt

Alpha\_BiI3.txt

Alpha\_Cs2AgBiBr6.txt

Alpha\_Cs2SnIn6.txt

Alpha\_Cs2TiBr6.txt

Alpha\_Cs3Bi2I9.txt

Alpha\_Cs3Sb2I9.txt

Alpha\_FA3Bi2I9.txt

Alpha\_InI\_0.txt

Alpha\_MA3Sb2I9.txt

Alpha\_MaPbI3.txt

Alpha\_Rb2SB2I9.txt

Alpha\_Sb2S3.txt

Amorphous\_Si\_Absorption\_coefficient.txt

BiOI\_absorption\_coefficient.asc

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**SUPPORTING INFORMATION**

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**FigS1**:

General information: Photoluminescence quantum efficiency measurements of BiOI and Cs-Sb-I-Cl of

Measured by: Dr Robert Hoye, Imperial College London, UK.

Methodological information:

The experimental details are given in the Article's Supporting information.

Data and file overview:

The data files are saved in .ASCII format, and can be analyzed with the MATLAB script provided (plotPhotostability.m).

Files:

Matlab script file: plotPhotostability.m

quartz\_BiOI.asc

quartz\_encap\_CSI.asc

BiOI\_0min.asc

BiOI\_1min.asc

BiOI\_2min.asc

BiOI\_3min.asc

BiOI\_4min.asc

BiOI\_5min.asc

BiOI\_6min.asc

BiOI\_7min.asc

BiOI\_8min.asc

BiOI\_9min.asc

BiOI\_10min.asc

BiOI\_21min.asc

BiOI\_25min.asc

BiOI\_30min.asc

BiOI\_35min.asc

BiOI\_40min.asc

BiOI\_67min.asc

CSI\_0min.asc

CSI\_1min.asc

CSI\_2min.asc

CSI\_3min.asc

CSI\_4min.asc

CSI\_5min.asc

CSI\_6min.asc

CSI\_7min.asc

CSI\_8min.asc

CSI\_9min.asc

CSI\_10min.asc

CSI\_11min.asc

CSI\_25min.asc

CSI\_30min.asc

**FigS3a and FigS3b:**

General information: Current density vs. voltage plots of the same BiOI devices under FL and WLED illumination 5 months apart.

Measured by: Yueheng Peng and Jianjun Mei, Soochow University, China.

Methodological information:

The experimental details are given in the Article's experimental section.

Data and file overview: Raw data files are saved in .csv format and can be opened with Excel/Origin.

Files:

FL: Figure S3a.csv

WLED: Figure S3b.csv

**FigS4a and Fig43b:**

General information: Current density vs. voltage plots of the same Cs-Sb-I-Cl devices under FL and WLED illumination measured 5 months apart.

Measured by: Yueheng Peng and Jianjiun Mei, Soochow University, China.

Methodological information:

The experimental details are given in the Article's experimental section.

Data and file overview: Raw data files are saved in .csv format and can be opened with Excel/Origin.

Files:

FL: Figure S4a.csv

WLED: Figure S4b.csv

**FigS5**:

General information: Statistical spread of the open-circuit voltage, short-circuit current density, fill factor and power conversion efficiency of BiOI and Cs-Sb-I-Cl devices under FL and WLED illumination measured after 5 months of storage inside a glovebox.

Measured by: Yueheng Peng and Jianjiun Mei, Soochow University, China.

Methodological information:

The experimental details are given in the Article's experimental section.

Data and file overview:

The data files are saved as .csv format can be opened in Excel or Origin. Each of the .csv file contains data for both BiOI and Cs-Sb-I-Cl.

Files:

FF.csv

Jsc.csv

PCE.csv

Voc.csv

**FigS7**

General information: Short-circuit current limits of compounds with different bandgaps under radiative and SLME boundaries with different illuminations.

Analysed by: Tahmida N. Huq, University of Cambridge, UK.

Data and file overview: The JSC values have been obtained by running a script using equations described in Supporting Note S1 and saved as .csv format.

Files:

FigureS7.csv

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**References:**

1. R. L. Z. Hoye, L. C. Lee, R. C. Kurchin, T. N. Huq, K. H. L. Zhang, M. Sponseller, L. Nienhaus, R. E. Brandt, J. Jean, J. Al Polizzotti, A. Kursumović, M. G. Bawendi, V. Bulović, V. Stevanović, T. Buonassisi, J. L. MacManus-Driscoll, *Adv. Mater.* **2017**, *29*, 1702176