

Ashkan Abtahi

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Department of Physics and Astronomy, University of Kentucky

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Profile

- Self-motivated Ph.D. candidate studying charge transport in organic semiconductors
- Experimental techniques: Photoemission spectroscopies, Fabricating and characterizing OPVs, thermoelectrics, and organic electrochemical transistors
- Experience in modeling charge transport using Mathematica, MATLAB
- Experience in LabView and designing basic circuits, Microsoft Office

Education

Doctor of philosophy in Physics and Astronomy

December of 2020

University of Kentucky

Cumulative GPA: 3.83

Dissertation title: "A Theoretical and Experimental Study of Charge Transport in Organic Thermoelectric Materials and Charge Transfer States of Organic Photovoltaics"

Advisor: Professor K. R. Graham and Professor J. W. Brill

Master of science Physics and Astronomy

May of 2017

University of Kentucky

Dissertation title: "Effect of Halogenation on Energetics and Aggregation in Model Organic Photovoltaic System"

Advisor: Professor K. R. Graham and Professor J. W. Brill

Bachelor of science Physics and Astronomy

May of 2013

University of Tehran

Project title: "Analyzing received data from ionosphere in Very Low Frequency (VLF) range and detection of solar flare in VLF range" Advisor: Dr. A. Abasi

Research Intrests

- Investigating electronic transport in organic semiconducting materials to expand and improve the knowledge about the thermoelectric properties and charge transport in OPV and TE modules.
- Investigating charge transport in Organic-Inorganic composites and interfaces for improving the efficiency and stability of electronic devices such as OPV and TE especially in flexible devices.

Research Experiences

University of Kentucky

- **Photoemission spectroscopy** (XPS, UPS and IPES) of organic and organic-inorganic films
- Fabricating and testing devices for measuring **thermoelectric properties**
- **Doping** organic semiconductors, especially π -conjugated polymers using conventional dopants or electrochemistry
- Designed a **setup** for measuring temperature dependent thermoelectric properties of π -conjugated polymers using organic electrochemical transistors (**OECT**)

- Fabricating and testing thermoelectric composites
- **Modeling charge transport** in π -conjugated polymer and polymer blend using analytical methods using Mathematica and MATLAB
- **LabVIEW program development** (J-V characteristic and EQE of OPVs devices, running electron lamp for IPES, electrochemical transistor for testing temperature dependent TE properties of polymers)
- **Setup of an external quantum efficiency (EQE)** measurement system for low-noise measurements of charge transport states energy in OPV
- Analyzing surface modification of Perovskite films by calculating **surface coverage** with XPS for improving performance and stability
- Familiar with handling and operating **UHV** systems
- Atomic force microscopy (AFM) for probing morphology and thickness of organic thin films
- Familiar with GIWAXS images to determining the packing and aggregation in organic thin films

University of Tehran

- Designing amplifier, frequency filter, short range transmitter and receiver for very low frequency (VLF) antenna with the purpose of detecting solar flare
- MATLAB (image processing for analyzing data from VLF antenna) and C++ (simple molecular dynamics simulation)

Other skills

- Programming: Microsoft Project, AutoCAD

Publications

- One work in process:
 - Anion size effect on TE properties of polymers via electrochemical transistors (first author)
- Liang, Z.; Choi, H. H.; Luo, X.; Liu, T.; **Abtahi, A.**; Ramasamy, U. S.; Hitron, J. A.; Baustert, K.; Hempel J. L.; Boehm, A. M.; Ansary, A.; Strachan, D. R.; Mei, J.; Risko, C.; Podzorov, V.; Graham, K. R.; “n-Type Charge Transport in Heavily p-Doped Polymers”, **Nat. Mater.**, **2020**, **Just Accepted**
- Park, S. M.; **Abtahi, A.**; Boehm, A. M.; Graham, K. R.; “Surface Ligands for Methylammonium Lead Iodide Films: Surface Coverage, Energetics, and Photovoltaic Performance”, **ACS Energy Lett.**, **2020**, **5**, **799-806**
- Boehm, A. M.; Liu, T.; Park, S. M.; **Abtahi, A.**; Graham, K.R.; “Influence of Surface Ligands on Energetics at FASnI₃/C₆₀ Interfaces and Their Impact on Photovoltaic Performance”, **ACS Appl. Mater. Interfaces**, **2020**, **12**, 5209-5218
- **Abtahi, A.**; Johnson, S.; Park, S. M.; Luo, X.; Liang, Z; Mei, J.; Graham, K. R.; “Designing π -Conjugated Polymer Blends with Improved Thermoelectric Power Factors” **J. Mater. Chem. A**, **2019**, **7**, 19774–19785.
- Wang, F.; Ye, Z.; Sarvari, H.; Park, S. M.; **Abtahi, A.**; Graham, K.; Zhao, Y.; Wang, Y.; Chen, Z. D.; Li, S.; “Humidity-Insensitive Fabrication of Efficient Perovskite Solar Cells in Ambient Air.” **J. Power Sources**, **2019**, **412**, 359–365.
- Park, S. M.; Mazza, S. M.; Liang, Z.; **Abtahi, A.**; Boehm, A. M.; Parkin, S. R.; Anthony, J. E.; Graham, K. R.; “Processing Dependent Influence of the Hole Transport Layer Ionization Energy

on Methylammonium Lead Iodide Perovskite Photovoltaics.” *ACS Appl. Mater. Interfaces*, **2018**, 10, 15548–15557.

- **Abtahi, A.**; Mazza, S. M.; Ryno, S. M.; Loya, E. K.; Li, R.; Parkin, S. R.; Risko, C.; Anthony, J. E.; Graham, K. R.; “Effect of Halogenation on the Energetics of Pure and Mixed Phases in Model Organic Semiconductors Comprised of Anthradithiophene Derivatives and C₆₀” *J. Phys. Chem. C*, **2018**, 122, 4757–4767
- Fursule, I. A.; **Abtahi, A.**; Watkins, C. B.; Graham, K. R.; Berron, B. J.; “*In situ* crosslinking of surface-initiated ring opening metathesis polymerization of polynorbornene for improved stability” *J. Colloid Interface Sci.*, **2018**, 510, 86–94.

Confrences and poster presentations

- **Oral** presentation at MRS Fall meeting at Boston, MA *Fall of 2019*
“*Increasing the Thermoelectric Power Factors in Pi-Conjugated Polymer Blends through Combining Experiment with Theory*”
- **Poster** at MRS Fall meeting at Boston, MA *Fall of 2019*
“*The Influence of Halogenation on Energetics in Pure and Mixed Phases in Model Organic Semiconductors Composed of Anthradithiophene Derivatives and C₆₀*”
- **Poster** at MRS spring meeting at Phoenix, AZ *Spring of 2019*
“*Influence of the Mobility Ratio and Energetics of π -Conjugated Polymers on the Thermoelectric Properties of Polymer Blends*”
- **Oral** presentation at APS March meeting at Boston, MA *Spring 2019*
“*Influence of the Mobility Ratio and Density of States Width on the Thermoelectric Properties of Polymer Blends*”
- **Poster** at MRS Fall meeting at Boston, MA *Fall of 2018*
“*Influence of the Mobility Ratio and Density of States Width on the Thermoelectric Properties of Polymer Blends*”
- **Poster** at MRS Fall meeting at Phoenix, AZ *Spring of 2018*
“*Halogenation Effects on Energetics in Pure and Mixed Phases of Model Organic Semiconductors*”
- **Poster** at NAFF symposium at university of Kentucky, KY *Spring of 2016*
“*Halogenation Effects on Energetics in Pure and Mixed Phases of Model Organic Semiconductors*”

Outreach Activities and Awards

- **President of MRS UK chapter** **2019- Present**
- **MRS University Chapter Special Projects** **2020**

- Holding a symposium for MRS UK chapter
“[Kentucky material networking day](#)” *Fall of 2019*
- **STEM** camp for elementary and middle school level students
“How to make solar cell” **2017-2019**

Teaching Experiences

University of Kentucky **2014 - 2018**

- Teacher assistant for General Physics I and II lab and recitation
- Modern Physics and Physics and astronomy for elementary teachers

Others

Beginner at martial art of Aikido, familiar with electric and acoustic guitar and Kamancheh, beginner in Arabic and German languages,

References (Available upon request)

Prof. Kenneth Graham

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Prof. Joseph Brill

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