

# Ziyad Thekkayil

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Department of Chemistry

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 <https://scholar.google.com/citations?user=u4Av1KcAAAAJ&hl=en>

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## Research Interests

Understanding the impact of surface chemistry on the electronic structure and dynamics of topological weyl semimetals using ultrafast nonlinear optical spectroscopy.

## Education

Ph.D., Temple University, Philadelphia, PA, USA

Fall 2022 – Present

Advisor: Prof. Eric Borguet

BSMS, Indian Institute of Science Education and Research, Pune

2018 – 2023

Advisor: Dr. Pankaj Mandal

## Research Experience

### I. Graduate Research Assistant at Temple University (2022- )

Advisor: Prof. Eric Borguet

1. “Impact of surface chemistry on the electronic structure and dynamics of topological Weyl semimetals”; **Ziyad Thekkayil**, Somaiyeh Dadashi, Prajwal Laxmeesha, Benjamin Roe, Daniel Strongin, Steven May, and Eric Borguet
2. “Development of high resolution nonlinear optical microscopy for interfacial studies”; Somaiyeh Dadashi, **Ziyad Thekkayil**, Eric Borguet
3. “Development of tunable repetition rate broadband mid-IR source for nonlinear spectroscopy”; **Ziyad Thekkayil**, Somaiyeh Dadashi, Eric Borguet
4. “NIR- $\nu$ SHG: A new nonlinear vibrational spectroscopy of interfaces”; Somaiyeh Dadashi, **Ziyad Thekkayil**, Hao Li, Bijoya Mandal, Eric Borguet

## II. Undergraduate research student at IISER Pune (2019-2022)

Advisor: Dr. Pankaj Mandal

Graduate Student Mentor: Ms. Shabnum Maqbool

- Studied nonlinear optical properties and charge carrier dynamics in lead halide perovskites.
- Developed a Z-scan spectrometer for nonlinear optical studies of perovskite thin films.
- Mentored a 1<sup>st</sup> year PhD student during the 4<sup>th</sup> year of my BSMS.
- Developed experience in fs-laser systems, optical alignment, ultrafast laser detection, generation of THz pulse via laser-induced air plasma, THz time-domain spectroscopy, and data analysis of optical pump – THz probe spectroscopy and optically-heterodyne-detected optical Kerr effect spectroscopy.

### **Publications**

- **Ziyad Thekkayil**, Somaiyeh Dadashi, Prajwal Laxmeesha, Steven May and Eric Borguet. “Probing the Spin Polarized Topological Bands in Antiferromagnetic Weyl Semimetal Mn<sub>3</sub>Sn with Broken Time-Reversal Symmetry” (*Manuscript under preparation*)
- Somaiyeh Dadashi, **Ziyad Thekkayil**, Hao Li, Bijoya Mandal, Eric Borguet. “NIR-vSHG: A new nonlinear vibrational spectroscopy of interfaces” (*Manuscript under preparation*)
- Shabnum Maqbool, Garvit Bansal, Gurivi Reddy Yettapu, **Ziyad Thekkayil**, and Pankaj Mandal. “Ultrafast charge carrier dynamics in Formamidinium lead bromide nanocrystals using time-resolved Terahertz spectroscopy” (*Manuscript under preparation*)
- **Ziyad Thekkayil**, Shabnum Maqbool, Riteeka Tanwar, and Pankaj Mandal. “Broadband Tunability of Third Harmonic Upconversion in Pyridinium Lead Halides” *ACS Photonics*, **2023**. <https://doi.org/10.1021/acsp Photonics.3c01279>
- Shabnum Maqbool, **Ziyad Thekkayil**, and Pankaj Mandal. “1D Diisopropylammonium Lead Iodide Perovskite Shows Exceptional Optical Stability and Third-Order Nonlinearity” *Advanced Optical Materials*, **2023**, 2202942. <https://doi.org/10.1002/adom.202202942>
- Shabnum Maqbool, Tariq Sheikh, **Ziyad Thekkayil**, Swati Deswal, Ramamoorthy Boomishankar, Angshuman Nag, and Pankaj Mandal. “Third Harmonic Upconversion and Self-Trapped Excitonic Emission in 1D Pyridinium Lead Iodide” *The Journal of Physical Chemistry C*, **2021**, 125, 22674-83. <https://doi.org/10.1021/acs.jpcc.1c07639>

## Presentations

- **Ziyad Thekkayil**, Somaiyeh Dadashi, Prajwal Laxmeesha, Steven May and Eric Borguet. “Second Harmonic Generation Spectroscopic Study of Weyl Semimetal  $Mn_3Sn$  with Broken Time-Reversal Symmetry”; MRS Fall 2023 Meet (Nov 26 – Dec 01, 2023)
- Ziyad Thekkayil, Somaiyeh Dadashi, Eric Borguet. “Development of ultrafast broadband tunable repetition rate mid-IR sources”; ACS YCC Fall 2023 Poster Session (August 23, 2023)

## Honors and Achievements

- Selected for IISER Pune – Temple University DMDD (Dual Masters Doctoral Degree) program. Admitted for PhD program at Temple University in the pre-final year of the BSMS program at IISER Pune (2022).
- Awarded Government of India Dept. of Science & Technology INSPIRE-SHE (Innovation in Science Pursuit for Inspired Research – Scholarship for Higher Education) (2018 – 2023).

## Conference Duties

- Symposium assistant, MRS Fall 2023 Meet (Nov 26 – Dec 01, 2023)

## Teaching Experience

- Teaching Assistant, Temple University Chemistry, General Chemistry Laboratory I, Spring 2023, Course Faculty: Dr. John B. Michael (Current)
- Teaching Assistant, Temple University Chemistry, General Chemistry Laboratory I, Fall 2022, Course Faculty: Dr. John B. Michael (Aug-Dec 2022)

## Extra-Curricular Activities

- IISER Pune Sports Club Coordinator, 2021-22
- Elected Member of the first Student Council of IISER Pune, 2020-21
- Organizer, IISER Pune Kho-Kho League 2020
- Bronze Medal, Kho-Kho, Inter IISER Sports Meet 2019
- Founding member of SQIL, an organization for development of scientific temper and motivation for careers in science among high school students ([www.sqil.in](http://www.sqil.in))

## Software Skills

<ul style="list-style-type: none"><li>➤ Python – data analysis and instrument control</li><li>➤ LabVIEW – instrument control</li><li>➤ Gaussian – Electronic structure calculations</li><li>➤ MATLAB</li><li>➤ IgorPro</li></ul>	<ul style="list-style-type: none"><li>➤ OriginPro</li><li>➤ ChemDraw</li><li>➤ EndNote</li><li>➤ SciDAVis</li><li>➤ MS Office</li></ul>
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## Instrument & Technical Skills

<ul style="list-style-type: none"><li>• Operation, maintenance, and minor troubleshooting of ultrafast lasers.</li></ul> <p>Worked with:</p> <ol style="list-style-type: none"><li>1. Millenia – Tsunami – Spitfire XP (Regenerative Amplifier system, Spectra-Physics)</li><li>2. Libra (Coherent)</li><li>3. Monaco (Coherent)</li><li>4. TOPAS-C and TOPAS-Prime (OPA, Light Conversion)</li><li>5. ORPHEUS-HP (OPA, Light Conversion)</li></ol>	<ul style="list-style-type: none"><li>• THz pulse generation via laser-induced air plasma</li><li>• Lock-in amplifier (SRS 830)</li><li>• Oscilloscope (Tektronix MSO 4000B)</li><li>• Function Generator (Tektronix AFG3000)</li><li>• Raman microscope (HORIBA HR Evolution Raman Microscope)</li><li>• FTIR spectrometer</li><li>• UV-Vis spectrometer</li><li>• Synthesis of hybrid lead monohalide &amp; mixed halide perovskite single crystals</li><li>• Powder X-Ray Diffractometer</li></ul>
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