

IOANA A. ZELKO, PHD

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EDUCATION

Harvard University Ph.D in Astronomy and Astrophysics	2016–August 2021
Harvard University Master of Arts in Astronomy and Astrophysics	2014–2016
Massachusetts Institute of Technology Bachelor of Science in Physics	2010–2014

PRIZE FELLOWSHIPS

CITA Postdoctoral Fellowship , <i>Canadian Institute for Theoretical Astrophysics</i> Out of 207 applicants	2022–2025
Pierce Fellowship , <i>Harvard Center for Astrophysics</i> Given to the highest ranked PhD applicants	2014

AWARDS

Malcolm Cotton Brown Award , <i>MIT Physics Department</i> Awarded to a senior of high academic standing in physics who plans to pursue graduate study in experimental physics.	2014
Special Prize for Excellence , <i>Romanian League for Students Abroad</i>	2014
Gold Medal , <i>International Olympiad on Astronomy and Astrophysics</i>	Iran, 2009
Bronze Medal , <i>International Physics Olympiad</i>	Croatia, 2010
Bronze Medal , <i>International Astronomy Olympiad</i>	China, 2009
Leprince Ringuet Prize , <i>Ecole Polytechnique de Paris and CNRS/IN2P3</i>	2009
IFA Prize , <i>Institute of Atomic Physics</i>	Bucharest, 2009
Excellence Prize , <i>Romanian Ministry of Education</i>	2007–2009
Honor Prize , <i>Bucharest City Hall</i>	2008
National Prize , <i>National Physics Olympiad of Romania</i>	2007–2009
Perfect Score , <i>National Astrophysics Olympiad of Romania</i>	2010

PUBLICATIONS

Links to my [arXiv preprints](#), [ADS Publications](#), and [ORCID 0000-0002-7588-976X](#).

- “Deep DECam Y-band Follow-up of WISEA J153429.75–104303.3 (a.k.a. “The Accident”)”
Aaron M. Meisner, ..., Ioana Zelko et al., (2023), <https://iopscience.iop.org/article/10.3847/2515-5172/acc033>
- **Highlight**: “The First 3D 3II Map of the Temperature of the Dust in the Milky Way Galaxy”
Ioana Zelko and Douglas Finkbeiner, <https://arxiv.org/abs/2211.07667>, under review
- **Highlight**: “Constraints on Sterile Neutrino Models from Strong Gravitational Lensing, Milky Way Satellites, and the Lyman- α Forest”
Ioana Zelko et al., *Physical Review Letters*, Volume 129, Issue 19, article id.191301 (2022), <https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.129.191301>

- “The Dark Energy Camera Plane Survey 2 (DECaPS2): More Sky, Less Bias, and Better Uncertainties”
Saydjari, ..., Ioana Zelko et al., (2022), <https://iopscience.iop.org/article/10.3847/1538-4365/aca594>
- “The first Global e-Competition on Astronomy and Astrophysics ”,
Ioana Zelko et al. , conditionally accepted for publication in the American Journal of Physics).
- “Deriving Stellar Properties, Distances, and Reddenings using Photometry and Astrometry with BRUTUS”,
Joshua Speagle, Catherine Zucker, ..., Ioana Zelko, et al., accepted for publication in The Astrophysical Journal (2021).
- “Mapping the Milky Way in 5-D with 170 Million Stars”,
Joshua Speagle, Catherine Zucker, ..., Ioana Zelko, et al., accepted for publication in The Astrophysical Journal (2021).
- **Highlight:** “Impact of Dust on CMB Spectral Distortions”
Ioana Zelko and Douglas Finkbeiner, <https://arxiv.org/abs/2010.06589>, The Astrophysical Journal, Volume 914, Number 1 (2021).
- **Highlight:** “Implications of Dust Size Distributions Variation for dust emissivity- R_V Correlation”,
Ioana Zelko and Douglas Finkbeiner, <https://arxiv.org/abs/2009.11869>, The Astrophysical Journal, Volume 904, Issue 1, id.38, 22 pp (2020).
- “Brute-Force Mapmaking with Compact Interferometers: A MITEoR Northern Sky Map from 128 MHz to 175 MHz”,
Haoxuan Zheng, Max Tegmark, ..., Ioana Zelko, et al., MNRAS, 465, 3 (2017). <https://arxiv.org/pdf/1605.03980.pdf>
- **Highlight:** “MITEoR: a scalable interferometer for precision 21 cm cosmology”,
Haoxuan Zheng, Max Tegmark, ..., Ioana Zelko, et al., MNRAS, 445, 12 (2014). <http://arxiv.org/abs/1405.5527>
- “Mapping our Universe in 3D with MITEoR”,
Haoxuan Zheng, Max Tegmark, ..., Ioana Zelko, et al., proceedings of 2013 IEEE International Symposium on Phased Array Systems and Technology. <http://arxiv.org/abs/1309.2639>

JOURNAL REFEREE

[Nature Astronomy](#)
[The Astrophysical Journal \(ApJ\)](#)
[The Monthly Notices of the Royal Astronomical Society Letters \(MNRASL\)](#)
[Advances in Astronomy](#)
[Physica Scripta](#)
[International Conference on Physics, Mathematics and Statistics \(ICPMS\)](#)
[Astronomy Education Journal \(AEJ\)](#)

RESEARCH EXPERIENCE

Astrophysics Researcher - Postdoctoral Fellow

Canadian Institute for Theoretical Astrophysics (CITA)

2022-2025

- Conducted cutting-edge research in theoretical astrophysics, focusing on dark matter, the radiative properties of our galaxy, or cosmology).
- Developed and implemented advanced computational models to investigate astrophysical phenomena and explore the underlying physical processes.

- Collaborated with a multidisciplinary team of researchers and faculty members, contributing to the advancement of knowledge in the field of astrophysics.
- Authored and co-authored peer-reviewed research articles in high-impact scientific journals, disseminating research findings to the broader scientific community.
- Presented research findings at national and international conferences, engaging in scientific discussions and fostering collaborations with fellow researchers.
- Actively participated in weekly seminars and discussion groups, contributing to the intellectual exchange of ideas and staying up-to-date with recent advancements in the field.
- Mentored and supervised undergraduate and graduate students, providing guidance and support in their research projects and academic development.
- Secured research grants and funding from various sources, ensuring the continuity of research activities and resources.
- Participated in public outreach activities, promoting the understanding of astrophysics and inspiring future generations of scientists.

PREVIOUS RESEARCH POSITIONS

Strong Lensing Constraints on Dark Matter

University of California - Los Angeles

September 2021–present

Postdoctoral Work. 1. For certain classes of dark matter theories, figuring out what would be the growth of structure, and what observables they would have, leading to comparisons with data. 2. Forecasting the sensitivity for strong lensing of the next generation adaptive optics system to be install at the Keck Telescope.

PhD Thesis Work

Harvard University, Prof. Douglas Finkbeiner

September 2014–August 2021

Completed a significant new study of interstellar dust grains, their variations in size and composition, and the effects on interstellar extinction. Studied contribution from interstellar and non-galactic dust on the detection of the spectral distortions of the cosmic microwave background. Created [the first 3D map of the temperature of the interstellar medium dust](#).

Mapping Dust in 3D with DECam: A Galactic Plane Survey

Harvard University, Prof. Douglas Finkbeiner

January 2019

Took data as a single observer on location for 8 consecutive nights using the Blanco Telescope at Cerro Tololo in Chile. This represented the final data acquisition for [DECaPS, the dust mapping project done with the DECam](#).

The Extreme Universe Space Observatory On Board the Japanese Extreme Module (JEM - EUSO) on the International Space Station

RIKEN Astrophysics Research, Japan, Prof M. Casolino, and Prof T. Ebisuzaki

June–August 2014

Produced a first order estimate of the time that JEM-EUSO spends being exposed to a significant source of ultraviolet radiation, coming from the Sun and from the Moon. I first considered the direct radiation coming from the Sun and the Moon. In doing so, I also confirmed the results published in the group. Then, I showed the necessary calculations to see if there is radiation coming from reflection of the Sun and the Moon in the Earth's Oceans.

Digital Correlator Design of the MIT Epoch-of-Reionization experiment (MITEoR)

MIT Kavli Inst. for Space Research, Prof. Max Tegmark

February 2012–Fall 2013

MITEoR is a prototype of a scalable Fourier transform telescope, with precision calibration, whose ultimate goal is to create a 3D map of the universe, and provide new information on the epoch of reionization, inflation, dark matter, dark energy, and neutrino masses. I designed and implemented a novel system for 64 dual-polarization antennas interferometer that can process and save the data in real time using Field Programmable Gate Arrays (FPGAs).

Flight Simulator Project

Tecnológico de Monterrey, Mexico, Prof. Rick L Swenson

Summer 2011–January 2012

Studied how to configure FPGAs, to help test work done on establishing the communication between the control panels and the main computer of a flight simulator for Boeing 737.

COLLABORATIONS

Dust Buster , *Co-I, NASA Goddard* 2022- present
Primordial Inflation Explorer (PIXIE) , *Co-I, NASA Goddard* 2021- present
Pan-Ex Galactic Science Group 2021-present
MIT Epoch of Reionisation Experiment (MITEoR), *Massachusetts Institute of Technology* 2012-2014

TEACHING EXPERIENCE

Harvard Teaching Fellow *Spring 2020*

Served as a teaching fellow for the COMPSCI 109B: Data Science 2: Advanced Topics in Data Science taught by Dr. Pavlos Protopapas, Dr. Mark Glickman. Topics covered: machine learning, neural networks, bayesian inference.

USA Astronomy and Astrophysics Olympiad Coach *2017-2019*

Served as a coach for the USA team for the International Olympiad on Astronomy and Astrophysics through weekly training sessions during the 3-4 months online training period. Served as a lecturer at the 7 days the MIT training camp.

Harvard Teaching Fellow *Fall 2015*

Served as a teaching fellow for the undergraduate class SPU21: Stellar Understanding of the Universe, taught by Professor Jonathan ("Josh") Grindlay.

MIT Tutor *Spring 2012*

I met with 4 students independently, helping them clarify concepts from the class 6.007 Electromagnetic Energy: From Motors to Lasers.

MIT Laboratory Assistant *Spring 2011*

Introduction to Electrical Engineering and Computer Science Class at MIT (up to 15 hours a week).

OUTREACH

During my PhD I did a substantial amount of outreaching for the USA Astronomy and Astrophysics Competition (Olympiad) for high school students. The goal of the competition is to send ten students to the International Olympiad of Astronomy and Astrophysics, every year. I served as a coach and team leader for the students for 3 years, set up the training program, found funding (20k/per year donation from the Mason Family) and legal representation for the program, expanded the publicity efforts, and created the board of directors

Chairperson of the board of the USA Astronomy and Astrophysics Competition Foundation (US-AAAO) *2019-Present*

Created the board; organized the structure of the foundation; organized the meetings of the board; created the training program; the publicity program; successfully did fundraising; supervised the general direction of the organization. Website: <https://usaaao.org/>

Academic Committee Member of the Global e-Competition on Astronomy and Astrophysics (GeCAA) *2020*

GeCAA is the online edition of the International Olympiad on Astronomy and Astrophysics, which moved online in 2020 due to the global epidemic. An academic committee of ten people was formed to oversee the competition for the 40 participating countries. Website: <http://www.ioaastrophysics.org/gecaa/>

Team Leader and Coach the for International Olympiad on Astronomy and Astrophysics *2017-2019*

USA National Team, 11th IOAA, Phuket, Thailand

USA National Team, 12th IOAA, Beijing, China

USA National Team, 13th IOAA, Keszthely, Hungary

Director of the USA Astronomy and Astrophysics Competition Foundation *2017*

Promoted the competition. Organized the two rounds of selections for students, including creating the exams for the rounds. Organized and served as a lecturer for the 7 days MIT summer training camp for the top 15 students. Served as a coach for the USA team for the International Olympiad of Astronomy and Astrophysics through weekly training sessions. Lead the team at the IOAA.

Founder of Physics Den *2016-present*

PhysicsDen (www.physicsden.org) is a website where users can solve and write physics problems that bridge the gap between course material and research. It was accepted in the MIT Sandbox startup program, and funded with \$4000. I was the leader of the 4 member team.

EQUITY AND INCLUSION

USAAAO Training Program for Underrepresented Minorities and Students with Limited Educational Resources

2019–present

Set the base for the online summer training program at USAAAO for high school students aiming to bring astronomy resources to URM students and students exposed to limited educational resources.

CfA Equity and Inclusion Journal Club

2017–2020

Attended sessions and read literature.

FUNDRAISING

USA Astronomy and Astrophysics Olympiad

2017–present

Secured a yearly recurring donation of \$20000 for the USAAAO program to fund the transportation and participation fees of the team at the International Olympiad on Astronomy and Astrophysics.

Founder of Physics Den

2016–present

PhysicsDen (www.physicsden.org) is a website where users can solve and write physics problems that bridge the gap between course material and research. It was accepted in the MIT Sandbox startup program, and funded with \$4000. I was the leader of the 4 member team.

TALKS

***invited *Romanian Science Festival**

April 2023

””Unveiling the Secrets of the Universe’s Composition”/”Dezvãluind Secretele Compoziției Universului” - invited speaker

***Canadian Institute for Theoretical Astrophysics, Toronto, Canada**

March 2023

Cosmology Journal Club - ” Constraining dark matter candidates using gravitational strong lensing” - invited speaker

***University of California, Irvine - Particle/Cosmology Journal Club, Romania**

March 2023

”Exploiting the Synergy between Cosmology and Galactic Science” - invited speaker

***ICHB Gala, Bucharest, Romania**

December 2022

”Astrophysics Researcher as a Profession” - invited speaker

Galactic Science and CMB Foregrounds, Tenerife, Spain

December 2022

”The First 3π 3D Map of Galactic Dust Temperature”

***Pan-Experiment Galactic Science Group**

November 2022

”The First 3π 3D Map of Galactic Dust Temperature” - invited speaker

***Lorentz Center, Leiden University**

November 2022

Mission: Spectro-Polarimetry of the Microwave Sky Workshop: ”Dust Foregrounds and Science” - invited speaker

University of California, Los Angeles - 3M Postdoctoral Association Competition

May 2022

”Figuring out What the Universe is Made of” - competitor

***University of California, Merced - Astronomy Journal Club**

May 2022

”Figuring out What the Universe is Made of: Constraining Sterile Neutrino Dark Matter Models Using Gravitational Strong Lensing” - invited speaker

***University of Florida - Astronomy Colloquium**

October 2021

”Stardust and Cosmology” - invited speaker

***3rd Shaw-IAU Workshop**

October 2021

”Competitions from the Perspective of a Student” - invited speaker

***CMB-S4 Collaboration**

August 2021

”Combining CMB Observations with Extinction Data to Create a 3D Dust Temperature Map” - invited speaker

***Gloucester Area Astronomy Club**

July 2021

”Stardust and Cosmology” - invited speaker

Harvard PhD Dissertation Colloquium

June 2021

”Stardust and Cosmology” - public PhD thesis colloquium

***Indian Institute of Science, Bangalore**

May 2021

”Dust and CMB Spectral Distortions” - invited speaker

*Pan-Experiment Galactic Science Group "Dust Extinction and Emissivity ($R_V - \beta$) parameters" - invited speaker	<i>May 2021</i>
*Harvard Academic Research Center PhD Student Panel - invited panelist	<i>April 2021</i>
Perimeter Institute for Theoretical Physics, Waterloo, Canada "Dust and CMB Spectral Distortions" - invited speaker	<i>January 2021</i>
*University of Wisconsin - Milwaukee "Dust and CMB Spectral Distortions" - invited speaker	<i>January 2021</i>
*Harvard Cosmology Journal Club "Implications of Grain Size Distribution and Composition for the Correlation Between Dust Extinction and Emissivity" - invited speaker	<i>September 2020</i>
235th American Astronomical Society Meeting "Implications of Dust Size Distributions Variations for Dust Emissivity-Extinction Correlation"	<i>January 2020</i>
MPIA, Heidelberg, Hanz-Walter Rix Group Meeting Presentation "Dust as a Foreground for CMB Spectral Distortions"	<i>October 2019</i>
234th American Astronomical Society Meeting "Dust as a Foreground for CMB Spectral Distortions"	<i>January 2019</i>

COURSEWORK AND TRAINING

Perimeter Institute TRISEP Summer Program Tri-Institute Summer School on Elementary Particles (TRISEP)	<i>2018</i>
Harvard Institute for Applied Computational Science Machine Learning Workshop	<i>2017</i>
Caltech Graviational Waves Astrophysics School	<i>2015</i>
Scuola Matematica Intrauniversitaria di Perugia Functional Analysis, Differential Equations	<i>2011</i>
Harvard University Cosmology, general relativity, radiative transfer processes, exoplanets, ISM, stellar astrophysics	
Massachusetts Institute of Technology Quantum Field Theory, general relativity, cosmology, quantum mechanics, quantum computation, statistical physics, E&M II, introductory string theory, real analysis, algebra, differential equations, algorithms, programming, introductory electrical engineering.	

SKILLS

Math/CS Deep learning Neural Networks Statistics Linear Algebra Multivariable Calculus Real & Complex Analysis	Software Python Mathematica Latex AI Prompting	Hardware VHDL FPGAs Matlab Simulink XBee Arduino
Languages English (fluent) Romanian (native) Spanish (conversational) Japanese (conversational) French (basic)	Sports Running – Half Marathons ’15-’19 <i>Run to Remember</i> ’13, ’17, ’18 <i>BAA</i> Skiing and Snowboarding Tennis Taekwondo – Blue Belt Karate Shito-ryu – Brown Belt	Driving Licenses Class D