Dr. S. Furkan Ozturk

PERSONAL INFORMATION

ADDRESS:	52 Oxford Street, Cambridge, MA 02138
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EMPLOYMENT

2025-	Assistant Professor of Geobiology and Geochemistry, Caltech, Pasadena, CA, USA
2025-	William H. Hurt Scholar, Caltech, Pasadena, CA, USA
2024-2027	Senior Member, King's College, Cambridge, UK
2024-2025	Kavli-Laukien Fellow, Harvard University, Cambridge, MA, USA

EDUCATION

2018-2024	Doctor of Philosophy (Ph.D.) in PHYSICS, Harvard University, Cambridge, MA
	Origins of life Advisor: Prof. Dimitar D. Sasselov

- 2018-2021 Master of Arts (M.A.) in PHYSICS, **Harvard University**, Cambridge, MA Atomic, molecular, and optical physics | Advisor: Prof. Markus Greiner
- 2014-2018 Bachelor of Science (B.Sc.) in PHYSICS, **Bilkent University**, Ankara, Turkiye Condensed matter theory | Advisor: Prof. Mehmet Ozgur Oktel CGPA: 3.99/4.00, *valedictorian*, highest ever in the department

AWARDS AND FELLOWSHIPS

2024-2027	Kavli-Laukien Prize Fellowship by Harvard Origins of Life Initiative
2024-2027	Stipendiary Research Fellowship by King's College, Cambridge
2024	Gertrude and Maurice Goldhaber Prize by Harvard Physics Department
2024	First place in JCI's Ten Outstanding Young Persons of the World (TOYP)
2024	Selected for the 73rd Lindau Nobel Laureate Meeting in Physics
2024	Ataturk Science Prize by the Ataturk Society of America
2024	Innovation Prize at AI Tomorrow Summit 2024 by AIPA
2018	Purcell Fellowship by Harvard University
2016	Best Project Award by Bilkent University Physics Department
All Semesters	High Honor Student at Bilkent University
2014-2018	Comprehensive Scholarship by Bilkent University
2014-2018	National Undergraduate Scholarship (2205) by TUBITAK
2014-2018	Presidential Scholarship by Turkish Prime Ministry
2010-2014	Selected for Turkey's national program for gifted students (BILSEM)

RESEARCH INTERESTS

Origins of life, Origins of homochirality, Spin-selective chemistry, Photochemistry, Geochemistry

- Studying the origins of homochirality and exploring the role of magnetic surfaces as potential chiral symmetry breaking agents due to the chiral induced spin selectivity (CISS) effect.
- Studying asymmetric chemical reactions controlled by electron spin due to the CISS effect.
- Studying the geochemical formation pathways of magnetic minerals on early Earth and their magnetic properties under natural geomagnetic fields.
- Exploring the role of triplet energy transfer and solar UV irradiation in prebiotic synthesis.
- Exploring spin-controlled asymmetric processes via electrochemistry with custom-designed magnetic electrodes.
- Performed ground state energy calculations for prebiotically relevant molecules with density functional theoretical methods and calculated singlet-triplet energy gaps.
- Experienced in computational chemistry, chemical visualization and analysis tools: Gaussian, HyperChem, Chemcraft, Chem 3D, ChemDraw, and MestReNova. Experienced in UV-VIS, FTIR, and circular-dichorism (CD) spectroscopy, and nuclear magnetic resonance (NMR).

Chiral-induced spin selectivity, Nitrogen-vacancy (NV) centers

- Studying the fundamentals of the CISS effect with NV centers in diamond.
- Designed and built a confocal microscope with an ultra-high-resolution objective, imaged single NV centers in diamond. Designed a large-area, low-scattering and uniform-field microwave antenna for optically-detected magnetic resonance of NV centers.
- Performed electron spin resonance (ESR), Rabi, Ramsey, Hahn Echo, CPMG, XY8-N, correlation spectroscopy, and double electron-electron spin resonance (DEER) experiments with shallow single NV centers in diamond.

PUBLICATIONS

- 11. Ozturk, S. F. and Sasselov, D. D. (2025) Life's Homochirality-Across a Prebiotic Network. In Review
- 10. Fransson, J., Kapon, Y., Brann, L., Yochelis, S., Sasselov, D. D., Paltiel, Y., & **Ozturk, S. F.** (2025). Chiral Phonons Enhance Ferromagnetism. *The Journal of Physical Chemistry Letters*, 16(8), 2001-2007.
- 9. Kapon, Y., Brann, L., Yochelis, S., Fransson, J., Sasselov, D. D., Paltiel, Y., **Ozturk, S. F.** (2024) Nonclassical temperature dependence of chirality-induced magnetization and its implications for RNA's homochirality. *arXiv preprint arXiv:2412.05720. In Review*
- 8. Ozturk, S. F. (2024). A New Spin on the Origin of Biological Homochirality (Doctoral dissertation, Harvard Graduate School of Arts and Sciences).
- 7. Su, L., Douglas, A., Szurek, M., Groth, R., **Ozturk, S. F.**, Krahn, A., ... & Greiner, M. (2023). Dipolar quantum solids emerging in a Hubbard quantum simulator. *Nature* 622, 724–729.
- Ozturk, S. F., Bhowmick, D. K., Kapon, Y., Sang, Y., Kumar, A., Paltiel, Y., Naaman, R. & Sasselov, D. D. (2023). Chirality-induced avalanche magnetization of magnetite by an RNA precursor. *Nature Communications*, 14(1), 6351.
- 5. **Ozturk, S. F.**, Sutherland J. D., & Sasselov, D. D. (2023). The central dogma of biological homochirality: How does chiral information propagate in a prebiotic network? *Journal of Chemical Physics*, 159(6), 061102.
 - *Research Highlight* Cover story of the issue and selected as a featured article by the editor.
- 4. Ozturk, S. F., Liu, Z., Sutherland, J. D., & Sasselov, D. D. (2023). Origin of biological homochirality by crystallization of an RNA precursor on a magnetic surface. *Science Advances*, 9(23), eadg8274.

• Research Highlight

Service, Robert. (2023). 'Breakthrough' could explain why life molecules are left- or right-handed. *Science*, 380-6650.

- Research Highlight Saplakoglu, Yasemin. (2023). Magnetism May Have Given Life Its Molecular Asymmetry. *Ouanta Magazine*
- 3. Ozturk, S. F. & Sasselov, D. D. (2022). On the origins of life's homochirality: Inducing enantiomeric excess with spin-polarized electrons. *PNAS*, 119(28), e2204765119.
 - Research Highlight Greed, S. (2022). The dawn of asymmetry. Nature Reviews Chemistry, 1-1.
 - *Commentary* Bloom, B. P., Waldeck, A. R., & Waldeck, D. H. (2022). Homochirality and chiral-induced spin selectivity: A new spin on the origin of life. *PNAS*, 119(34), e2210505119.
- 2. **Ozturk S. F.**, Aybar E., Oktel M. Ö. (2020). Temperature dependence of the density and excitations of dipolar droplets. *Physical Review A*, 102(3), 033329.
- 1. Phelps, G. A., Hébert, A., Krahn, A., Dickerson, S., **Ozturk, S. F.**, Ebadi, S., Su, L., & Greiner, M. (2020). Sub-second production of a quantum degenerate gas. *arXiv preprint arXiv:2007.10807*.

PATENTS

1. Chiral separation. Attorney Docket No. 51198-044001, Filed on Feb 9th, 2023. (pending)

SERVICE

- 1. Reviewer for the following journals, covering a broad range of disciplines: *Nature Communications, The Journal of the American Chemical Society, The Journal of Chemical Physics, Astrobiology.*
- 2. Lab Safety Officer (LSO), Sasselov Research Group. Responsible for monitoring chemical procurement, usage, and disposal, as well as maintaining lab safety protocols. Duties included troubleshooting instruments, training staff, and ensuring compliance with self-inspection standards.
- 3. Created and participated in initiatives for public engagement in science (e.g., *Cracking Chirality*), including the production of educational content and open-access lectures on physics and coding through a personal YouTube channel.

PROFESSIONAL EXPERIENCE AND COLLABORATIVE RESEARCH

- 1. Project contributor to the FRQ-FNRS bilateral program in collaboration with Prof. Yves Geerts, ULB (PRE-FRQ-FNRS, Number 40030130)
- 2. Contributing to a time-resolved study on chiral electron dynamics from magnetic substrates in collaboration with Prof. Sarah King, UChicago.
- 3. Ongoing collaborative research with the groups of Prof. Yossi Paltiel, HUJI; Prof. Rich Harrison, Cambridge University; Prof. Roger Fu, Harvard; Prof. Donna Blackmond, Scripps Research.

2023 February-March	Sutherland Group, MRC Laboratory of Molecular Biology PhD Thesis Research
Medical Research	Studied the photochemistry of aldehyde-bisulfite adducts and reduction reactions facilitated by iron-oxide surfaces. Investigated the crystallization of an RNA precursor on magnetite surfaces, in the presence of various other prebiotically relevant compounds.
Council	Host: Prof. John D. Sutherland
2023 February-March	<i>The Tosca Lab, University of Cambridge</i> PhD Thesis Research
UNIVERSITY OF	Synthesized authigenic magnetite minerals under various conditions by oxidizing ferrous iron. Explored the green rust pathway as a plausible scenario to produce magnetite on early Earth. Analyzed the magnetite crystals by Raman spectroscopy and x-ray diffraction. Magnetic properties of the samples will be analyzed to elucidate their magnetic domain size and remanent magnetization.
CAMBRIDGE	Host: Prof. Nicholas Tosca
2022 October-November	Naaman Research Group, Weizmann Institute of Science PhD Thesis Research
מכוז ויצמן למדע	Studied chirality induced magnetization of magnetic surfaces due to the CISS effect. Performed crystallization experiments with an RNA precursor on magnetite and analyzed the induced mag- netization by CD spectroscopy, SQUID, and Magneto-optical Kerr effect microscope. Measured the intrinsic spin-polarization of an RNA precursor using magnetic-conductive AFM.
WEIZMANN INSTITUTE OF SCIENCE	Host: Prof. Ron Naaman
2022 APRIL-MAY	Naaman Research Group, Weizmann Institute of Science PhD Thesis Research
מכוז ויצמן למדע	Studied spin-selective reduction of chiral molecules due to the CISS effect on magnetite surfaces. Performed electrochemical reduction experiments using magnetic working electrodes and stud- ied the enantioselective reduction of aldehyde cyanohydrins.
WEIZMANN INSTITUTE OF SCIENCE	Host: Prof. Ron Naaman
2017 September-2018 August	Oktel Research Group, Bilkent University Senior Thesis Work
Res Dograma	Worked on the modified Gross-Pitaevskii Equation for self-bound droplets. Created a compu- tational scheme based on GP Equation to describe self-bound droplets. Examined the effect of temperature, studied the expansion dynamics and oscillation modes of the droplets.
Ont Univers	Advisor: Prof. Mehmet Ozgur OKTEL
2017 June - August	<i>Greiner Lab, Harvard University</i> Undergraduate Internship
	Developed digital PID system to control the intensity fluctuations of a laser beam using an FPGA. Ultra low noise laser is then used to create optical lattices as a part of the Fermi Gas Microscope Advisor: Prof. Markus GREINER
2016 June - August	<i>Quantum Photonics Group, ETH Zurich</i> Undergraduate Internship
ETH zürich	Studied the photon statistics of polariton condensates and examined the optimization of the second-order coherence function for intrinsically squeezed polaritons. Advisor: Prof. Atac IMAMOGLU
2015 JUNE - AUGUST	Tait Research Laboratory, Indiana University Bloomington Undergraduate Internship
A CONTRACTOR OF	Developed MatLab code for 2D supramolecular packing interactions on a surface. Generated input files for calculations via Spartan and developed optimization algorithms. Advisor: Prof. Steven L. TAIT
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TEACHING AND MENTORING

- FALL 2024, Harvard University CfA Mentor for the Science Research Mentoring Program (SRMP) at the Harvard-Smithsonian Center for Astrophysics, guiding high school students through year-long independent research projects.
- APRIL 5TH, 2024, Harvard University Guest lecturer for "ASTRO 305: Topics in Origins of Life Research" on Origin of Life's Homochirality.
- SPRING 2024, Hebrew University of Jerusalem, Paltiel Lab Supervised physics Ph.D. student *Yael Kapon* (email) from Yossi Paltiel's lab at HUJI in experimental work. Yael worked on the temperature dependence of chirality-induced magnetization.
- NOVEMBER 7TH, 2023, Washington University Guest lecturer for "ASTBIO 502: Astrobiology Special Topics" on Origin of Life's Homochirality.
- FALL 2023, Harvard University Physics Department Teaching fellow for the lab component of PHYSCI 2: Mechanics, Elasticity, Fluids, and Diffusion
- JULY 2023, Harvard University, Sasselov Lab Assisted biochemistry Ph.D. student *Sreekar Wunnava* (email) from Dieter Braun's lab at LMU in experimental work. Sree worked on enantioselective polymerization of RNA nucleotides on magnetic surfaces.
- JUNE 2022 JUNE 2023, Harvard University, Sasselov Lab Supervised astrophysics Master's student *Victor Loi* (email) in experimental work. Victor worked on separating chiral compounds relevant to prebiotic chemistry and used analytical tools like XPS, AFM, and SEM to analyze magnetic surfaces.
- JANUARY 2023, Harvard University, Sasselov Lab Assisted chemistry Ph.D. student *Jinhan Yu* (email) from Donna Blackmond's lab at The Scripps Research Institute in experimental work. Jinhan worked on enantioseparation of dipeptides on magnetite surfaces.
- SUMMER 2022, Harvard University, Sasselov Lab Supervised biochemistry undergraduate intern *Cindy Zhou* (email) in experimental work. Cindy built a potentiometer with an ion-selective electrode and measured the concentration of sulfite anions in water.
- SPRING 2020, Harvard University, Greiner Lab Supervised physics Master's student *Robin Groth* (email) in experimental work. Robin built a Fizeau interferometer to align an optical lattice to a high resolution objective.
- SPRING 2017, Bilkent University Physics Department Solved problem sets and assisted term projects for PHYS212: Modern Physics

INVITED TALKS

- 16. Origin of Biological Homochirality by Crystallization of an RNA Precursor on a Magnetic Surface Crystal Growth and Assembly Gordon Conference; June 25th, 2025; Southern New Hampshire University
- 15. Origin of Life's Homochirality From Magnetic Minerals to a Homochiral Genome Planetary Science Seminar; January 21, 2025; Caltech
- 14. A New Spin on the Origin of Homochirality Research Seminar; January 16, 2025; University of Chicago
- 13. *A New Spin on the Origin of Homochirality* Chirality, Spin and Reactivity; November 12-14, 2024; International Solvay Institutes for Physics and Chemistry
- 12. *A New Spin on the Origin of Homochirality* Spin Transport in Molecular and Nanoscale Systems; June 23rd, 2024; ICPP-13
- 11. A New Spin on the Origin of Homochirality Computations in Science Seminar; May 8th, 2024; Chicago University

- 10. *A New Spin on the Origin of Homochirality* Leverhulme Centre for Life in the Universe Seminar; May 1st, 2024; Cambridge University
- 9. Origin of Biological Homochirality by Crystallization of an RNA Precursor on a Magnetic Surface Astrobiology Colloquium; April 16th, 2024; University of Washington
- 8. Origin of Biological Homochirality by Crystallization of an RNA Precursor on a Magnetic Surface Consensed Matter Theory Seminar; March 19th, 2024; Harvard University
- 7. Origin of Biological Homochirality by Crystallization of an RNA Precursor on a Magnetic Surface Centre for Origin and Prevalence of Life; December 15th, 2023; ETH Zurich
- 6. Origin of Biological Homochirality by Crystallization of an RNA Precursor on a Magnetic Surface Life in the Universe II; September 14th, 2023; American Academy of Arts and Sciences
- 5. Origin of Biological Homochirality by Crystallization of an RNA Precursor on a Magnetic Surface Prebiotic Chemistry and Early Earth Environments Consortium; July 20th, 2023; Online
- 4. Origin of Biological Homochirality by Crystallization of an RNA Precursor on a Magnetic Surface Center for the Origins of Life; June 29th, 2023; Chicago University
- 3. Origin of Biological Homochirality by Crystallization of an RNA Precursor on a Magnetic Surface Origins of Life Initiative; April 6th, 2023; Harvard University
- 2. *Magnetization and Solving the Chirality Problem* Leverhulme Centre for Life in the Universe Annual Meeting; March 10th, 2023; Cambridge University
- 1. *Magnetization and Solving the Chirality Problem* Leverhulme Centre for Life in the Universe Coffee Meetings; March 2nd, 2023; Cambridge University

ORAL AND POSTER PRESENTATIONS

- 17. **Ozturk S. F.**, Sasselov D. D. *A New Spin on the Origin of Biological Homochirality* Poster presented at: Origins Federation Conference; 2024 September 11th; Cambridge, UK
- 16. Ozturk S. F., A New Spin on the Origin of Biological Homochirality Oral presentation at: Chirality 2024; 2024 August 28th; Kyoto, Japan
- 15. Ozturk S. F., Origin of Biological Homochirality by Crystallization of an RNA Precursor on a Magnetic Surface Talk at: CISS Seminars organized by Jonas Fransson; 2024 February 28th; Zoom
- 14. Ozturk S. F., Origin of Biological Homochirality by Crystallization of an RNA Precursor on a Magnetic Surface Talk at: The Center for Astrophysics Lunch Seminars; 2023 October 19th; Harvard CfA
- 13. Ozturk S. F., Origin of Biological Homochirality by Crystallization of an RNA Precursor on a Magnetic Surface Chalk Talk Lecture at: Harvard Origins of Life Initiative; 2023 April 6th; Harvard University
- 12. Ozturk S. F., Origin of Biological Homochirality by Crystallization of an RNA Precursor on a Magnetic Surface Talk at: CISS Seminars organized by Jonas Fransson; 2023 March 29th; Zoom
- 11. Ozturk S. F., Sasselov D. D. On the Origins of Life's Homochirality in Nature: A New Spin Poster presented at: Life in the Universe Workshop; 2022 Oct 24-28; Sofia
- 10. Ozturk S. F., On the Origins of Life's Homochirality in Nature: A New Spin Talk at: CISS Seminars organized by Jonas Fransson; 2022 Sept 25th; Zoom
- 9. Ozturk S. F., On the Origins of Life's Homochirality in Nature: A New Spin Oral Presentation at: Bilkent University Department of Physics Seminars; 2022 Sept 8th; Ankara
- 8. **Ozturk S. F.**, Sasselov D. D. *On the Origins of Life's Homochirality: Inducing Enantiomeric Excess with Spin-Polarized Electrons* Poster virtually presented at: Latsis Symposium 2022: The Origin and Prevalence of Life; 2022 Aug 30-Sept 2; Zurich
- 7. Ozturk S. F., On the Origins of Life's Homochirality: Inducing Enantiomeric Excess with Spin-Polarized Electrons Oral Presentation at: Chirality 2022; 2022 July 20th; Chicago, IL

- 6. Ozturk S. F., Sasselov D. D. On the Origins of Life's Homochirality: Inducing Enantiomeric Excess with Spin-PolarizedElectrons Poster virtually presented at: Molecular Origins of Life; 2022 June 16-17; Munich
- 5. Ozturk S. F., On the Origins of Life's Homochirality: 5W 1H Oral presentation at: EGU General Assembly, Life as a Planetary Phenomenon; 2022 May 23-27; Vienna
- 4. Su L., Groth R., Krahn A. J., Hebert A. H., **Ozturk S. F.**, Phelps G. A., and Greiner M. *Towards single-site imaging of an erbium quantum gas microscope*. Poster virtually presented at: DAMOP; 2021 May 31-June 4
- 3. Su L., Hebert A. H., Krahn A. J., **Ozturk S. F.**, and Greiner M. *A Proposal for Synthetic Gauge Fields with Erbium in an Optical Lattice*. Poster virtually presented at: DAMOP; 2020 June 1-4
- 2. **Ozturk S. F.**, Hebert A. H., Krahn A. J., Phelps G. A., and Greiner M. *Towards an Erbium Quantum Gas Microscope*. Poster presented at: Quantum Many-Body Systems Winter School; 2019 Mar 10-16; Arizona.
- 1. Ozturk S. F., Orthogonal Functions and Applications of the Sturm-Liouville Theory in Quantum Mechanics Oral presentation at: Spring Mathematics Meeting; 2018 Feb 24-25; Istanbul

CONFERENCES

12-14 Nov 2024	International Solvay Institutes for Physics and Chemistry, Brussels, Belgium
10-13 Sept 2024	Origins Federation Conference Cambridge, UK
26-29 Aug 2024	Chirality 2024, 34th International Symposium on Chirality Kyoto, Japan
30 June-5 July 2024	The 73rd Lindau Nobel Laureate Meeting in Physics Lindau, Germany
23-28 June 2024	International Conference on Porphyrins and Phthalocyanines Niagara Falls, NY
12-15 SEPT 2023	Workshop: Life in the Universe II Cambridge, MA
10 March 2023	Leverhulme Centre for Life in the Universe Annual Meeting Cambridge, UK
24-28 Oct 2022	Workshop: Life in the Universe Sofia, Bulgaria
30 Aug-2 Sept 2022	Latsis Symposium 2022: The Origin and Prevalence of Life Zurich (Virtual)
17-20 July 2022	Chirality 2022, 32th International Symposium on Chirality Chicago, IL
16-17 June 2022	Molecular Origins of Life Munich (Virtual)
23-27 May 2022	European Geophysical Union (EGU) General Assembly Vienna, Austria
25-27 August 2021	Molecular Origins of Life Munich (Virtual)
10-16 March 2019	ITAMP Quantum Many-Body Systems Winter School, Biosphere 2, AZ
4-8 March 2019	APS March Meeting, Boston, MA
8-10 October 2018	ITAMP Quantum Phases of Fermions in Optical Lattices Workshop, Cambridge, MA

COMPUTER SKILLS

Advanced Knowledge: Python, Zemax, CAD (Inventor and Solid Works), MatLab, Mathematica Basic Knowledge: COMSOL, Verilog, LATEX

LANGUAGE SKILLS

Turkish:	Native	GERMAN:	B1
English:	Fluent	LATIN:	1 Year of Roman Latin

SCIENCE OUTREACH

- I have a YouTube channel with over **80.000 subscribers** and **2.5 million views** to guide young students on their careers in science. I put educational videos to teach basic physics, coding and other auxiliary skills. I join meetings and interviews to share my experiences with students from diverse backgrounds to increase their involvement with basic sciences.
- Participated in Cracking Chirality, a twelve-minute film for a general audience by Chemistry Shorts, exploring how the essential molecules of life, such as DNA, RNA, and proteins, acquired their homochiral structures and how magnetic rocks at the bottom of a prebiotic lake may have set the stage for life as we know it.
- Contributed to the Unexplainable podcast series by Vox, participating in a discussion on life's homochirality for public audience.
- Participated in a science outreach project recorded by Trinity College Cambridge, featuring a discussion on life in the universe with Prof. David Catling.