**ANDREW K. SAYDJARI**

Graduate Student | Harvard Physics

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**RESEARCH INTERESTS**

I work at the interface of **data science** and **astrophysics**, developing new statistical tools to analyze large datasets. In terms of methods, I am intrigued by the low-SNR limit, **uncertainty quantification**, and blind signal separation problems. In terms of astrophysics, I strive to better understand the **chemistry** of **interstellar dust**.

**EDUCATION**

**Harvard University**:PhD in Physics2018-2024

Advisor: Douglas Finkbeiner

Thesis: Statistical Models of the Spatial and Chemical Complexity of Dust

**Yale University**:BS/MS in Chemistry, BS in Mathematics2014-2018

Thesis: Optimizing the Nickel-Catalyzed Carboxylation of Aryl Halides

Graduate-Level Courses: 7 in Physics, 8 in Chemistry

GRE: 880 Chem (94%), 870 Phys (81%), 170 Quant (99%), 170 Verb (97%), 5 Writ (93%)

**Lincoln High School, WI (Public)** 2010-2014

13 AP Courses (5/5)

2 Univ. Wisconsin Courses

**SELECTED AWARDS & HONORS**

Best Astrostatistics Student Paper Award (ASA/AIG) 2022

Bok Center Certificate of Distinction in Teaching (Harvard) Fall 2021

Hertz Fellowship Finalist 2018, 2019

NSF Graduate Research Fellowship (USA) 2018

Howard Douglass Moore Prize (Yale) 2018

Chemistry department’s highest honor, awarded to a single graduating undergraduate

Barry Goldwater Scholar (USA) 2017

Phi Beta Kappa 2017

DAAD-RISE Fellowship (Yale/Germany) 2016

Research internship exchange

**PROFESSIONAL ACTIVITIES & SERVICE**

**Institute for Artificial Intelligence and Fundamental Interactions (IAIFI)**

Computing Committee June 2022-present

Technical Editor, Journal of Epsilon Alpha Mu Society 2017

English Language Editor, Max Planck Institute for Polymer Research 2016-2020

**SELECTED PRESENTATIONS**

**Invited Conference Talks**

JSM 2022: Astrostatistics Interest Group: Student Paper Award August 2022

Photometry on Structured Backgrounds: Local Pixelwise Infilling by Regression

**Contributed Conference Talks**

DECam at 10 Years Workshop September 2022

The Dark Energy Camera Plane Survey 2 (DECaPS2): More Sky, Less Bias,

and Better Uncertainties

Interstellar Institute #5: With Two Eyes July 2022

Component Separation: An Application to Gaia RVS and APOGEE Spectra

AAS 240: Computation, Data Handling, Image Analysis June 2022

The DECam Plane Survey (DECaPS2): Optical photometry of 3.3 billion stars in the southern Galactic plane

APS: March Meeting March 2019

Enhancing Superconductivity in Indium Arsenide Quantum Well Heterostructures

**Invited Seminars & Journal Clubs**

CFA: Institute for Theory and Computation (ITC) Lunch March 2022

Photometry on Structured Backgrounds

University of Toronto: Statistics and MachIne LEarning (SMILE) Journal Club February 2022

Photometry on Structured Backgrounds

IAS: Pan-Experiment Galactic Science Group July 2021

Learning from ISM Texture using the Wavelet Scattering Transform

LPENS: AstroLunch December 2020

Scattering Transform Methods: Applications to Galactic Dust

**Flash Talks & Posters**

Institute for Artificial Intelligence and Fundamental Interactions (IAIFI) September 2022

Seeing the Future: A Conference in Honour of Alyssa Goodman May 2022

Harvard-Heidelberg Star Formation Conference November 2020

Center for Integrated Quantum Materials (CIQM) October 2019

**Undergraduate Science Competitions**

Gulf Coast Research Conference, Rice University [Best Presentation] 2017

Ivy League STAR Competition [Award of Excellence] 2017

Columbia Science Symposium [Award of Excellence] 2016

National Collegiate Research Conference, Harvard [Plenary] 2016

Yale Research Symposium [Grand Prize] 2015

**PUBLICATIONS**

I am an author on **16+ papers** that have **280+** citations(h-index=8). This includes:

**7+ papers** as **(co-)lead author** with 130+citations

**5+ papers** with **significant contributions** with 149+citations

Most of my papers can be found online on [ADS](https://ui.adsabs.harvard.edu/search/filter_author_facet_hier_fq_author=AND&filter_author_facet_hier_fq_author=author_facet_hier%3A%220%2FSaydjari%2C%20A%22&filter_doctype_facet_hier_fq_doctype=AND&filter_doctype_facet_hier_fq_doctype=doctype_facet_hier%3A%220%2FArticle%22&fq=%7B!type%3Daqp%20v%3D%24fq_author%7D&fq=%7B!type%3Daqp%20v%3D%24fq_doctype%7D&fq_author=(author_facet_hier%3A%220%2FSaydjari%2C%20A%22)&fq_doctype=(doctype_facet_hier%3A%220%2FArticle%22)&p_=0&q=%20author%3A%22saydjari%22&sort=date%20desc%2C%20bibcode%20desc), though citations outside astronomy are missing.

My ORCID is [0000-0002-6561-9002](https://orcid.org/0000-0002-6561-9002).

**Publications as (Co-)Lead Author:**

1. **Saydjari, A. K.**; Schlafly, E. F.; Lang, D.; Meisner, A. M.; Green, G. M.; Zucker, C.; Zelko, I.; Speagle, J. S.; Daylan, T.; Lee, A.; Valdes, F.; Schlegel, D.; Finkbeiner, D. P.

2022, arXiv:2206.11909 (submitted ApJS) Grad

[The Dark Energy Camera Plane Survey 2 (DECaPS2): More Sky, Less Bias, and Better Uncertainties](https://ui.adsabs.harvard.edu/abs/2022arXiv220611909S/abstract)

1. **Saydjari, A. K.**;Finkbeiner, D. P.

2022, ApJ, 933, 155. Grad

[Photometry on Structured Backgrounds: Local Pixel-wise Infilling by Regression](https://ui.adsabs.harvard.edu/abs/2022ApJ...933..155S/abstract)

1. **Saydjari, A. K.**;Finkbeiner, D. P.

2022, arXiv:2014.11244 (accepted TPAMI) Grad

[Equivariant Wavelets: Fast Rotation and Translation Invariant Wavelet Scattering Transforms](https://ui.adsabs.harvard.edu/abs/2021arXiv210411244S/abstract)

1. **Saydjari, A. K.**;Portillo, S. K. N.; Slepian, Z.; Kahraman, S.; Burkhart, B.; Finkbeiner, D. P.

2021, ApJ, 910, 122. Grad

[Classification of Magnetohydrodynamic Simulations using Wavelet Scattering Transforms](https://ui.adsabs.harvard.edu/abs/2021ApJ...910..122S/abstract)

1. **Saydjari, A. K. & Weis, P**.; Wu, S.

2016, Adv. Energy Mat., 7, 1601622. Undergrad

[Spanning the Solar Spectrum: Azopolymer Solar Thermal Fuels for Simultaneous UV and Visible Light Storage](https://onlinelibrary.wiley.com/doi/abs/10.1002/aenm.201601622)

**Cover Article:** [AEM](https://onlinelibrary.wiley.com/doi/abs/10.1002/aenm.201770012)

1. **Saydjari, A. K.**; Pietron, J. J.; Simpkins, B. S.

2015, Electroanalysis., 27, 1960-1967. HS

[Electrochemical Deposition and Spectroelectro-chemical Response of Bromophenol Blue Films on Gold](https://onlinelibrary.wiley.com/doi/abs/10.1002/elan.201500136)

1. **Saydjari, A. K.**; Pietron, J. J.; Simpkins, B. S.

2014, Chem. Phys. Lett., 608, 328-333. HS

[Optical Interference Effect Corrections for Absorbance Spectra of Layer-by-Layer Thin Films Bearing Covalently Bound Dye](https://www.sciencedirect.com/science/article/abs/pii/S0009261414005004)

**Publications with Significant Contributions:**

1. Lesser, O.; **Saydjari, A. K.;** Wesson M.; Yacoby, A.; Oreg, Y.

2021, PNAS, 118, 27. Grad

[Phase-induced topological superconductivity in a planar heterostructure](https://doi.org/10.1073/pnas.2107377118)

1. Alegria, L.D.; Bøttcher, C.G.; **Saydjari, A. K.;** Pierce, A.T.; Lee, S.H.; Harvey, S.P.; Vool, U.; Yacoby, A.;

2021, Nature Nanotechnology, 16, 404-408. Grad

[Phase-induced topological superconductivity in a planar heterostructure](https://doi.org/10.1073/pnas.2107377118)

1. Charboneau, D.J.; Brudvig, G.W.; Hazari, N.; Lant, H.M.C; **Saydjari, A. K.**

2019, ACS Catal., 9, 3228-3241. Undergrad

[Development of an Improved System for the Carboxylation of Aryl Halides through Mechanistic Studies](https://pubs.acs.org/doi/10.1021/acscatal.9b00566)

1. McKee, A.; Solano, M.; **Saydjari, A. K.;** Bennett, C.J.; Hud, N.V.; Orlando, T.M.

2018, ChemBioChem, 19, 1-6. Undergrad

[A Possible Path to Prebiotic Peptides Involving Silica and Hydroxy Acid-Mediated Amide Bond Formation](https://chemistry-europe.onlinelibrary.wiley.com/doi/abs/10.1002/cbic.201800217)

**Cover Article:** [ChemBioChem](https://chemistry-europe.onlinelibrary.wiley.com/doi/full/10.1002/cbic.201800488)

1. Wang, D.; Wagner, M.; **Saydjari, A. K.**; Wu, S.; Butt, H.

2017, Chem. Eur. J., 23, 2628-2634. Undergrad

[A Photoresponsive Orthogonal Supramolecular Complex Based on Host–Guest Interactions](https://chemistry-europe.onlinelibrary.wiley.com/doi/abs/10.1002/chem.201604634)

**Publications as a Contributing Author:**

1. Cantat-Gaudin, T. et al. [13 additional co-authors including **Saydjari, A. K.]**

2022, arXiv:2208.09335 (submitted A&A) Grad

[**An empirical model of the Gaia DR3 selection function**](https://ui.adsabs.harvard.edu/abs/2022arXiv220809335C/abstract)

1. Sayres, C. et al. [12 additional co-authors including **Saydjari, A. K.]**

2022, Proceedings of the SPIE, 12184 Grad

[**SDSS-V robotic focal plane system: overview of coordinate systems and transforms**](https://ui.adsabs.harvard.edu/abs/2022SPIE12184E..7KS/abstract)

1. Speagle, J. S. & Zucker, C. [17 additional co-authors including **Saydjari, A. K.]**

2021, (accepted ApJ) Grad

Mapping the Milky Way in 5-D with 170 Million Stars at High Galactic Latitudes

1. Speagle, J. S. & Zucker, C. [17 additional co-authors including **Saydjari, A. K.]**

2021, (submitted ApJ) Grad

Deriving Stellar Properties, Distances, and Reddenings from Photometry and Astrometry with brutus.

**TEACHING**

I care passionately about teaching and love ideating new ways of explaining difficult concepts. I emphasize the development of hands-on teaching methods, incorporating active learning through experiment and data-based exploration. I view creating an inclusive atmosphere, in which all students can comfortably learn, as a top priority.

Harvard University, Teaching Fellow Fall 2021

Solid State Physics, Lecture, Undergrad/Grad, 27 students, w/Prof. Julia Mundy

Feedback: [Student Evaluations](https://andrew-saydjari.github.io/files/PHYS195A_Reviews.pdf)

Yale University, Peer Tutor 2015-2018

Physical Chemistry, Lab, Undergrad, 30 students, w/Prof. Patrick Vaccaro

Physical Chemistry II, Lecture, Undergrad, 30 students, w/Prof. Patrick Vaccaro

Freshman Organic Chemistry II, Lecture, Undergrad, 100 students, w/Prof. Alanna Schepartz

Sophomore Organic Chemistry I, Lecture, Undergrad, 120 students, w/Prof. Jonathan Ellman

SPLASH/SPROUT @ Yale, Middle School Teacher 2015-2018

Peeling Back the Layers of Solar Cells (30 students), Metal Mania: Simple Models of the Material World (4 students), Destressing Tensors (7 students), Abstract Algebra: Questions Teachers Didn’t Answer (60, 75 students), Origins of Life: A Chemist’s Perspective (16, 35 students)

**OUTREACH & ENGAGEMENT**

Cambridge Science Festival, MIT Museum Presentation Volunteer Fall 2022

Galaxy Zoo presentation

Latino Initiative Program, Instructor Summer 2021 & 2022

Developed and delivered introductory courses in PYTHON (ML x Astro, Package management)

Harvard Observation Project, Co-Mentor 2020-2021

Co-mentored (w/ Dominic Pesce) extension school student on implementing “online blind deconvolution” for short exposure imaging.

LitKit: Educational Fluorescence Microscopy Kit, Non-Profit Co-founder 2017-2019

Developed a safe, cost-effective educational kit to transform a standard secondary school microscope into a fluorescent microscope.

**PRESS**

[Abstract: The Future of Science](https://anchor.fm/abstractcast/episodes/Ep--31---Harvard-Astrophysics-Machine-Learning--Interstellar-Dust-Clouds-ft--Andrew-Saydjari-eo91g7), Machine Learning & Interstellar Dust Clouds December 2020

**RESEARCH MENTORS**

**Harvard University, Physics**:Prof. Douglas FinkbeinerAugust 2020-present

Designing and characterizing new statistical tools to address the spatial and chemical complexity of dust in the interstellar medium (ISM). Examples include turbulence parameter estimation from simulations, developing and implementing a pipeline to perform photometry on structured backgrounds, creating the largest photometric catalog (in terms of number of objects obtained with a single camera), and developing Marginalized Data-space Gaussian Inference for Component Separation (MaDGICS) to improve catalogs of diffuse interstellar bands (DIBs).

**Harvard University, Physics**:Prof. Amir YacobyJuly 2018-August 2020

Engineering and investigating topological states of matter. Key questions include unambiguous detection, quantifying "topological protection," and decoherence mechanisms. Experimental focus on Josephson phenomenon using InAs and HgTe quantum wells. Repaired dilution refrigerator. Simulated, fabricated, and characterized first zig-zag Josephson junctions.

**Yale University, Physics**:Prof. Michel DevoretJanuary 2018-June 2020

Designing, fabricating, and measuring novel 3D Josephson junction geometries. *In situ* fabrication of a completely enclosed junction to improve junction coherence times, reproducibility, and processibility.

**Yale University, Chemistry**:Prof. Nilay HazariAugust 2016-May 2018

Performing mechanistic studies on nickel catalyzed carboxylation of aryl halides using carbon dioxide. Designing low-valent metal traps for study of kinetics of precatalyst activation. Mechanistic studies will then be used to direct the development of highly efficient catalysts.

**Yale University, Chemistry**:Prof. Charles SchmuttenmaerSeptember 2015-May 2016

Rebuilt terahertz spectrometer from scratch in pursuit of the first circular dichroism spectrum using terahertz-time domain spectroscopy.

**Georgia Institute for Technology, Chemistry**:Prof. Nicholas V. HudMay 2015-July 2015

Reached record polypeptide lengths under prebiotically plausible conditions by examining a novel system which simultaneously explored the role of surfaces and mixtures on Early Earth. Elucidated the mechanism for observed unprecedented protection (with applications to food science). This work provided confirmation of plausibility of the peptide world hypothesis.

**U.S. Naval Research Lab**:Dr. Blake SimpkinsJun 2013-August 2014

Achieved first direct electrochemical deposition of bromophenol blue on gold. Characterized film growth with respect to deposition variables and demonstrated electrochemical control of film optical states. Fabricated and analyzed polyelectrolyte multilayer films using spectroscopy and microscopy. Analyzed spectra and developed a mathematical model for spectral correction.

**SELECTED RESEARCH SKILLS**

**Computational**

Developer: Julia (2 years, primary), Python (7 years), MATLAB (3 years)

Developed pipelines and managed >100k core-h runs in both Julia and Python

Managed daily simultaneous multi-instrument measurements in MATLAB

User: SQL, Spark, LABVIEW, IgorPro, Origin, Mathematica

**Simulation Packages**

Quantum: Kwant, Guassian09/16, GAMESSUS, Quantum Espresso

Radiative Transfer: RADMC-3D

**Laboratory**

Fabrication: EBL, RIE, ALD, Photolithography, Thermal/E-beam/Sputtering Deposition

Characterization: (S)TEM/EDX, FIB, SEM, AFM

Analytical: (U)-HPLC-MS/MS, GC/MEMS, GPC-SES/FID

Electrochemistry: Cyclic Voltammetry (CV), Spectroelectrochemistry, Electrochemical depositions

DNA Sci: PCR, Gel Electrophoresis

Spectroscopy: Terahertz-Time Domain, SPR, XPS, NMR (1H, 13C, 31P, NOSEY), EPR

Misc.: Dynamic Light Scattering, Optical Trapping, Optical Contact Angle Measurement, Differential Scanning Calorimetry