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 Physics	2018-2024
Advisor: Douglas Finkbeiner	
Thesis: Statistical Models of the Spatial and Chemical Complexity of Dust	
Yale University: BS/MS in Chemistry, BS in Mathematics	2014-2018
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

Harvard Astronomy Department	
(1/2) Student Representatives to Faculty Search Committee (Elected)	Jan 2023-present
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

AAS 241: Dust   January 2023
    Measuring the 8621 Å Diffuse Interstellar Band in Gaia DR3 RVS Spectra:
    Obtaining a Clean Catalog by Marginalizing over Stellar Types

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 **17+ papers** that have **280+** citations (h-index=8). This includes:

   8+ 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](#), though citations outside astronomy are missing. My ORCID is [0000-0002-6561-9002](#).

Publications as (Co-)Lead Author:

1. **Saydjari, A. K.**; Zucker, C.; Peek, J. E. G.; Finkbeiner, D. P.
   2022, arXiv:2212.03879 (submitted ApJ)   Grad
   [Measuring the 8621 Å Diffuse Interstellar Band in Gaia DR3 RVS Spectra: Obtaining a Clean Catalog by Marginalizing over Stellar Types](#)
2. **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 (accepted ApJS)   Grad
   [The Dark Energy Camera Plane Survey 2 (DECaPS2): More Sky, Less Bias, and Better Uncertainties](#)
3. **Saydjari, A. K.**; Finkbeiner, D. P.
   2022, ApJ, 933, 155.   Grad
   [Photometry on Structured Backgrounds: Local Pixel-wise Infilling by Regression](#)
4. **Saydjari, A. K.**; Finkbeiner, D. P.
   2022, arXiv:2014.11244 (accepted TPAMI)   Grad
   [Equivariant Wavelets: Fast Rotation and Translation Invariant Wavelet Scattering Transforms](#)
5. **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](#)
6. **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](#)
   Cover Article: [AEM](#)
7. **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](#)
8. **Saydjari, A. K.**; Long, J.; Dressick, W.; 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](#)

Publications with Significant Contributions:

9. Lesser, O.; **Saydjari, A. K.;** Wesson M.; Yacoby, A.; Oreg, Y.
   2021, PNAS, 118, 27.   Grad
   [Phase-induced topological superconductivity in a planar heterostructure](#)

10. 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](#)
11. 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](#)

12. 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](#)
     Cover Article: [ChemBioChem](#)
13. 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](#)

Publications as a Contributing Author:

14. 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](#)
15. 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](#)
16. 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
17. 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](#)
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

Labroots, Grad Student Highlights   November 2022
Abstract: The Future of Science, Machine Learning & Interstellar Dust Clouds   December 2020

RESEARCH MENTORS

Harvard University, Physics: Prof. Douglas Finkbeiner   August 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 Yacoby   July 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 Devoret   January 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 Hazari   August 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.

Max Planck Institute for Polymer Research: Prof. Hans-Jürgen Butt   May 2016-August 2016

Designed and created an azopolymer-based solar thermal cell with record-breaking efficiency and gravimetric energy density. Calculated host-guest molecule geometries elucidating mechanism behind novel assemblies which lead to first photo-responsive orthogonal supramolecular systems.

Georgia Institute for Technology, Chemistry: Prof. Nicholas V. Hud   May 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.

Yale University, Chemistry: Prof. Charles Schmuttenmaer   September 2015-May 2016

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

U.S. Naval Research Lab: Dr. Blake Simpkins   Jun 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

I am a strong advocate of both open-source code and data, and I insist on public reproducibility of all plots in my work (see my Zenodo deposits accompanying my papers).

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

Developed pipelines and managed >100k core-h runs in both Julia and Python
Managed daily simultaneous multi-instrument measurements in MATLAB

Public Packages: LowRankOps.jl, KryburyCompress.jl, CloudCovErr.jl, EqWS.jl, crowdsource

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

Simulation Package User

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

Language

English (native), French (6 years)