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

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, though citations outside astronomy are missing. My ORCID is 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

2. **Saydjari, A. K.**; Finkbeiner, D. P.
   2022, ApJ, 933, 155.   Grad
   Photometry on Structured Backgrounds: Local Pixel-wise Infilling by Regression

3. **Saydjari, A. K.**; Finkbeiner, D. P.
   2022, arXiv:2014.11244 (accepted TPAMI)   Grad
   Equivariant Wavelets: Fast Rotation and Translation Invariant Wavelet Scattering Transforms

4. **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

5. **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

6. **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

7. **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

Publications with Significant Contributions:

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

9. 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

10. 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

11. 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](#)

12. 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:

13. 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](#)

14. 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](#)

15. 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

16. 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

[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.
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.
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.

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

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

Language

English (native), French (6 years)