

# David Ricardo Coria Hernandez

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## Education

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### University of Kansas, Lawrence, KS

PhD in Physics, Advisor: Ian Crossfield

Fall 2020 – Present

### Kansas State University, Manhattan, KS

Cum Laude, Bachelor of Science in Mathematics

May 2020

Cum Laude, Bachelor of Science in Physics

May 2020

## Research Positions

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### Graduate Research Assistant

Fall 2020 – Present

KU ExoLab, University of Kansas, Advisor: Ian Crossfield

## First Author Projects & Publications

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- **David R. Coria**, N. Hejazi, I. J. M. Crossfield, M. Rhem; *The Wanderer: Charting WASP-77A b's Formation and Migration Using a System-Wide Inventory of Carbon and Oxygen Abundances*, 2024, ApJ (accepted), doi: [10.48550/arxiv.2409.02286](https://doi.org/10.48550/arxiv.2409.02286)

There are only a handful of exoplanetary systems where we can make direct comparisons between host star chemical abundances and the chemical inventory of their sub-stellar companions. In this paper, we present a  $^{12}\text{C}/^{13}\text{C}$  abundance analysis for host star WASP-77A (whose hot Jupiter's  $^{12}\text{C}/^{13}\text{C}$  abundance was recently measured). Together with the inventory of carbon and oxygen abundances in both the host and companion planet, these chemical constraints point to WASP-77A b's formation beyond the  $\text{H}_2\text{O}$  and  $\text{CO}_2$  snowlines and provide chemical evidence for the planet's migration to its current location  $\sim 0.024$  AU from its host star.

- **David R. Coria**, I. Crossfield, J. Lothringer et al.; *The Missing Link: Testing Galactic Chemical Evolution Models with the First Multi-Isotopic Abundances in Dwarf Stars*, 2023 ApJ, 954, 121, doi: [10.3847/1538-4357/acea5f](https://doi.org/10.3847/1538-4357/acea5f)

I measure  $^{12}\text{C}/^{13}\text{C}$  and  $^{16}\text{O}/^{18}\text{O}$  ratios in a sample of well-studied solar twin stars, revealing that these isotopic ratios can be successfully derived from mid-infrared M band spectra. My measurements agree with several GCE models and archival  $^{12}\text{C}/^{13}\text{C}$  ratios within the uncertainties. This isotopic abundance analysis will be extended to K/M dwarf stars where GCE models lack crucial constraints.

## Research Practicum, University of New South Wales, Sydney, Australia

- **David R. Coria**, C. Bergmann, C. Tinney; *Veloce Quick Look App* Summer 2019

Developed an app intended for real-time data reduction and spectral extraction of echelle images produced by the Veloce spectrograph (as soon as data is recorded); use simplified processes rather than the complete process from the Veloce Reduction Pipeline.

## Contributing Author Publications

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- Neda Hejazi, J. Xuan, **D. Coria**, et al; *Chemical Links between a Young M-type T Tauri star and its Substellar Companion: Spectral Analysis and C/O Measurement of DH Tau A*, in prep. In the era of JWST and powerful ground-based observatories, we are obtaining astounding atmospheric constraints for directly imaged planets and brown dwarfs. Understanding their formation and evolution requires a complementary chemical analysis for their host stars; however, there are numerous challenges involved deriving abundances for such young stars of late spectral types. In this paper, we provide a volatile abundance analysis (accounting for the effects of rotation and veiling) of the young, T Tauri star DH Tau A (M2V) host to DH Tau b which lies on the planet-brown dwarf boundary. The C/O ratio of DH Tau A will provide a direct comparison to the sub-stellar companion DH Tau b.
- Neda Hejazi, Ian J. M. Crossfield, Diogo Souto et al. **incl. D. Coria**, 2024, *High-resolution Elemental Abundance Measurements of Cool JWST Planet Hosts Using AutoSpecFit: An Application to the Sub-Neptune K2-18b's Host M Dwarf*, ApJ, 973, 31, doi: [10.3847/1538-4357/ad61dc](https://doi.org/10.3847/1538-4357/ad61dc)

A high-resolution spectroscopic analysis of the M dwarf K2-18: host to a high-interest and prime JWST target sub-Neptune exoplanet in the star's habitable zone. In this paper, we introduce our new automatic, line-by-line, spectral fitting code, AutoSpecFit, which performs an iterative  $\chi^2$  minimization process to measure individual elemental abundances of cool dwarfs. We measure the abundance of 10 elements (C, O, Na, Mg, Al, K, Ca, Sc, Ti, and Fe) and derive the abundance ratios associated with several planet-building elements (Al/Mg, Ca/Mg, Fe/Mg, C/O) which can be used to constrain the chemical composition and the formation scenario of the exoplanet.

- Neda Hejazi, I. Crossfield, T. Norlander, M. Mansfield, **D. Coria** et al.; Detailed Elemental Abundances of a Super-Neptune Host Star Using High-Resolution, Near-Infrared Spectroscopy 2023, ApJ, 949, 79, doi: [10.3847/1538-4357/accb97](https://doi.org/10.3847/1538-4357/accb97)

We derive elemental abundances (C, O, Na, Mg, Al, Si, K, Ca, Ti, V, Cr, Mn, Fe) for exoplanet-host WASP-107 using a Gemini/IGRINS spectrum, TurboSpectrum, and MARCS models. We find near-solar abundances. These precise stellar abundances enable us to make a comparison with companion planet WASP-107b which is targeted by four JWST Cycle 1 programs in transit and eclipse.

- Alex S. Polanski, Jack Lubin, Corey Beard, et al; *The TESS-Keck Survey. XX. 15 New TESS Planets and a Uniform RV Analysis of All Survey Targets*, ApJS, 272, 32, doi: [10.3847/1538-4365/ad4484](https://doi.org/10.3847/1538-4365/ad4484)
- I. Crossfield, M. Malik, M. Hill, S. Kane, B. Foley, A. Polanski, **D. Coria**, et al.; GJ 1252b: A Hot Terrestrial Super-Earth with no Atmosphere, ApJL, 937, L17, 2022. doi:[10.3847/2041-8213/ac886b](https://doi.org/10.3847/2041-8213/ac886b)

## Invited, Contributed, and Public Presentations

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- **Invited Talk: Cool Stars 22 (San Diego, CA)** June 2024  
**Splinter Session: [Learning from the Coldest Worlds in the era of JWST](#)**  
Exoplanetary Origins: Unraveling Planetary Formation and Accretion Histories with CNO Isotopologues; doi: [10.5281/zenodo.13619959](https://doi.org/10.5281/zenodo.13619959)
- **AstroCoffee: Institute for Astronomy (University of Hawai'i at Mānoa)** April 2024  
Tracing Giant Exoplanet Formation: Complementary Host Star Abundances for Sub-Stellar CNO Isotopologue Detections

## Invited, Contributed, and Public Presentations (Continued)

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- **Accepted Talk: AAS 243 (New Orleans, LA)** January 2024  
Tracing Giant Exoplanet Formation Using Complementary Host Star CNO Abundances
- **Contributed Talk: Mid-America Regional Astrophysics Conference** November 2023  
Tracing Giant Exoplanet Formation Using Complementary Host Star CNO Abundances
- **Planetarium Show: Rocks & Rockets (Colby, KS)** August 2023  
Intro to Celestial Navigation
- **Contributed Talk: Towards Other Earths III (Porto, Portugal)** July 2023  
CNO Isotope Ratios Across Exoplanet Systems: Implications for Planet Formation and Atmospheric Composition
- **iPoster: AAS 241 (Seattle, WA)** January 2023  
The Missing Link: Testing Galactic Chemical Evolution Models with the First Multi-Isotopic Abundances in Solar Twin Stars
- **Special Session: AAS 241 (Seattle, WA)** January 2023  
It's Giving... Back: Advocating for Minority-Oriented Academic Success Programs as an Alum
- **iPoster: Cool Stars 21 (Toulouse, France)** July 2022  
The Missing Link: Testing Galactic Chemical Evolution Models with the First Multi-Isotopic Abundances in Solar Twin Stars
- **Contributed Talk: IR 2022 (Remote)** February 2022  
The Missing Link: Connecting Exoplanets and Galactic Chemical Evolution via Stellar Abundances: Isotopic Carbon and Oxygen Abundances in Solar Twin Stars
- **Invited Talk: McNair Heartland Research Conference (KC, KS)** September 2021  
Alumnix Panel
- **Invited Talk: Exoplanet Explorers Science Series (Remote)** April 2021  
The Missing Link: Connecting Exoplanets & Galactic Chemical Evolution via Stellar Abundances
- **Contributed Poster: Cool Stars 20.5 (Remote)** February 2021  
Measuring CO Isotopic Abundance Ratios in Solar Twin Stars; doi: [10.5281/zenodo.4563216](https://doi.org/10.5281/zenodo.4563216)
- **Contributed Talk: (Kansas City, KS)** September 2019  
**Ronald E. McNair Heartland Research Conference**  
Simplified echellogram data reduction and spectral extraction via the Veloce Quick Look App

## Service/Outreach

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- **Cool Stars 22: Splinter Session Co-Organizer (San Diego, CA)** Summer 2024  
[Planet-Host Cool Dwarfs: Tracing Planetary Formation & Composition with the Star-Planet Connection](#)  
In this session, we cover current methods and future improvements for measuring the physical parameters and individual elemental abundances of cool dwarfs. We also discuss how the chemistry of these host stars relates to protoplanetary disk composition and subsequent planetary formation and evolution.
- **[CubiMundos](#): Spanish CubeWorlds** Present  
A series of crafty, cube-shaped planets and moons. Now available en Español!

## Service/Outreach (Continued)

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- **NASA SCoPE Project w/ NASA UoL & GSAWN** 2024-Present  
[Las Estrellas y sus Compañeros: Developing Bilingual Activities & Resources for NASA's Universe of Learning](#)

This project seeks to develop new, engaging ways to share mainstream astronomical discoveries with local Hispanic communities. We build on the Girls STEAM Ahead with NASA (GSAWN) guidebook for educators by developing a new exoplanet-themed section with engaging activities and resources teaching the basics of exoplanet discovery and characterization. The project will also provide a professional Spanish translation of the entire GSAWN guidebook to boost the reach of the resource— not just to Spanish-speakers in Kansas, but across the nation and world.

- **KU Physics & Astronomy Locally Organized Assembly Co-Organizer** 2023-2024  
“PALOOZA” is an annual, GSO-sponsored research symposium open to both graduate and undergraduate students within the Geology, and Geography & Atmospheric Science departments to showcase our diverse research in a low-stakes and supportive environment.

- **Rocks & Rockets: KU Co-Organizer (Colby, KS)** August 2023  
Presented planetarium shows for a public science event in one of the most rural places in the US!

- **Traveling KU Planetarium: Co-Organizer and Presenter** 2021 -Present  
Present astronomy shows to the local schools & community with the Traveling KU Planetarium

- **NASA ExoExplorers: DEI Special Session at AAS** January 2023  
A session to dissect how members of marginalized communities navigate unique challenges throughout their scientific careers and what the astronomy community can do to lessen this impact on early career scientists.

- **Advocacy for Kansas-based TRIO/McNair programs** Spring 2022  
Wrote letters of support for TRIO staff advocating for continued federal funding of these programs to legislators in Washington, D.C.

- **KU Telescope Nights: Co-Organizer** 2021 – Present  
Plan and run monthly observing nights on campus for students and the community: telescope observing of the moon, solar system planets, star tours, constellation identification, etc.

## Teaching/Tutoring

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- **Graduate Teaching Assistant: Contemporary Astronomy Lab** Fall 2023  
KU ASTR 196: An introduction to astronomical observations and modern data analysis methods. Students carry out independent investigations as well as standard exercises.

- **Instructor: Lawrence High School** Spring 2023  
Served as instructor for a research astronomy course at Lawrence High, a minority-serving school. Taught students how to read and manipulate data from the Virgo Filament Survey using tools like Excel and TopCat. Worked through the entire research process: from literature reviews, developing research questions, data processing and analysis, poster development and practicing effective science communication. Each group created a research poster and presented it at their own research symposium.

- **Private Tutor: McNair Scholars Program** 2021-Present  
Tutored current KU McNair Scholars in both math and physics. This includes courses like College Algebra, Trigonometry, Calculus I, II, and III, Physics I and II.

## Observing Experience

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- **Keck I & II 10m Telescopes, W. M. Keck Observatory, HI**  
2 nights on NIRSPEC; 2 nights HIRES
- **4m Anglo-Australian Telescope, Siding Spring Observatory, NSW, Australia**  
3 nights on Veloce
- **3m NASA Infrared Telescope Facility, HI**  
2 nights on iSHELL
- **8.1m Gemini South Observatory, Cerro Pachon, Chile**  
PI of a successful proposal: “Elemental Abundances of the Coolest HWO Targets” (3 hours)

## Awards and Honors

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<a href="#">KU “I Am First Too” Commemorative Poster</a> Feature	Fall 2024
<a href="#">NASA SCoPE Seed Grant</a> Recipient	Spring 2024
Barbara J. Anthony-Twarog Outreach Award	Spring 2024
<a href="#">NASA Exoplanet Explorers Program</a> : Inaugural Cohort Member	2021
University of Kansas Graduate Fellow	Fall 2020 – Spring 2021
Hagan Scholarship Foundation Recipient	Fall 2016 – Spring 2020
McNair Scholars Program: Research Assistant	Fall 2018 – Spring 2020
Developing Scholars Program: Research Assistant	Fall 2016 – Spring 2019
Kansas State University Honor Roll	Fall 2016 – Spring 2020
Kansas State University Putnam (Distinguished University) Scholar	Fall 2016 – Spring 2020