COURTNEY CRAWFORD

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CAREER HISTORY

University of Sydney School of Physics *July 2022 - present*
Postdoctoral Researcher (Promoted to Level B in 2025)

Louisiana State University Physics & Astronomy *Graduation: May 2022*
Ph.D. in Physics

University of Oklahoma School of Physics & Astronomy *Graduation: May 2018*
B.S. in Astrophysics

HIGHLIGHTS

- 21 total publications, 7 first-authored
- Awarded promotion to Postdoctoral Researcher Level B
- Co-supervisor for two PhD students, Lead-supervisor for incoming PhD student
- Supervised three Honours students (two as primary supervisor)
- Supervised 19 undergraduate students (11 as primary supervisor)
- Developed lecture material for four different courses at USyd

RESEARCH SUMMARY

My research expertise is on the rare **Hydrogen-deficient Carbon (HdC) stars** and the technique of **asteroseismology**. My current work merges these two topics for the first time. I am also an expert in spectroscopy, time-domain astronomy, and stellar evolution modelling.

I have **published 7 first-authored articles, and co-authored 14 articles** in reputable journals such as Monthly Notices of the Royal Astronomical Society and Astronomy & Astrophysics. A full list of these articles is attached at the end of this document.

CONTRIBUTED & INVITED TALKS

The Properties of R Coronae Borealis Stars
Surveys and Photometry of Southern Stars *Invited, July 2026*

The Variability of Hydrogen-deficient Giants
Stars in Newcastle *2025*

The Extreme Helium Stars - A New Type of Stochastic Low-Frequency Variable
TASC9/KASC16 *2025*

Hydrogen-deficient Carbon Stars: What we know (and what we don't)
Seminar at USyd *2025*

Kepler Secondary Clump Stars: The Amplitude-Activity Relation
Stars in Brisbane *2024*

The HdC stars– updates on dust properties and the progenitor population
Seminar at Armagh *Invited, 2024*

The Dust Properties of R Coronae Borealis Stars
Advancements for Cool Evolved Stars *2024*

Hydrogen-deficient Carbon Stars: Advances in Formation and Dust Production
Seminar at Monash *Invited, 2024*

Hydrogen-deficient Carbon Stars– What happens after a white dwarf merger?
Seminar at ANU *Invited, 2023*

Hydrogen-deficient Carbon Stars– What happens after a white dwarf merger?
Seminar at UNSW *Invited, 2023*

Hydrogen-deficient Carbon Stars– The State of the Field
Seminar at Macquarie *Invited, 2022*

An MK-like Optical Spectral Classification Scheme for Hydrogen Deficient Carbon Stars and R Coronae Borealis Variables
AAS #240 *2021*

3D Mapping The Distribution of R Coronae Borealis Stars
AAS #238, id. 323.03 *2020*

Modeling Low Metallicity R Coronae Borealis Stars with MESA
Understanding Dust 30 Years After CCM *2019*

TEACHING & SUPERVISION

My teaching and supervision activities focus on student research and mentoring. Since 2022, I was the **primary supervisor for 11 undergraduate and two Honours students** and I am currently **co-supervisor for two PhD students**. I have supervised a total of 19 undergraduates and 3 Honours students. In Sem 1 2026 I will be acting as **lead-supervisor for a new incoming PhD student**. I also contribute to course design and delivery within the USyd School of Physics.

Courses Taught/Developed

- **OLES1603: Astronomy: Exploring the Universe** *(in development for Sem 1 2026, USyd)*
  Developed outline slides for the stars and galaxies lectures and participated in curriculum planning meetings.
- **OLET1638: Astronomy from Stars to Black Holes** *(Sem 1 2025 April Intensive, USyd)*
  Lectured for this four-session intensive course, substantially revising provided materials to align with updated quizzes.
- **OLET1636: Astronomy from Earth to Exoplanets** *(Sem 1 2025 March Intensive, USyd)*
  Lectured for this four-session intensive course, substantially revising provided materials to align with updated quizzes.
- **PHYS2014/PHYS2914: Data Science in Astronomy** *(2 Lectures, USyd, 2024 Sem 2)*
  Assisted in developing materials for a new data science course, and designed and delivered two lectures and labs on clustering techniques applied to stellar variability.
- **ASTR 1109: Stellar Astronomy Lab** *(4 semesters, LSU)*
  Sole instructor for four semesters. I developed four new labs, managed all curriculum and assessment, and received strong student feedback.

Current Students

- **Lea Schimak** *(PhD Student, co-supervisor, 2023-present)*
  Asteroseismology of binary red giants
- **Yingxiang Wang** *(PhD Student, co-supervisor, 2023-present)*
  Simple and accurate measurements of red giant asteroseismic parameters

Past Students

- **Julius Hamprecht & Michael Shen** *(SSP, co-supervisor with Lea Schimak, 2025 Sem 2)*
  Measuring Masses of Red Giant Stars with Asteroseismology and Machine Learning
- **Michael El-Hurr** *(SSP, sole-supervisor, 2025 Sem 2)*
  Temperature Class and Carbon Molecular Band Strengths of Hydrogen-deficient Carbon Stars During Pulsation
- **Jonas Káral** *(SSP, sole-supervisor, 2025 Sem 2)*
  Post-merger Simulations of DY Persei Variable Stars
- **Xander Buckingham** *(SSP, co-supervisor with Lea Schimak, 2025 Sem 1)*
  Convective Boundaries in He-burning Stellar Models

- **Josh Ferguson** *(Dalyell, sole-supervisor, 2025 Sem 1)*
  Characterisation of Radio Emitting Eclipsing Binaries
- **Isabella Treloar & Ozan Kocatepe** *(SSP, sole-supervisor, 2024 Sem 2)*
  Spectroscopy of pulsations in RCB and dLHdC stars
- **Haonan Li** *(Honours, sole-supervisor, 2024 Sem 1-present)*
  Anomalous peaks and potential tertiary systems found via Kepler oscillating star data
- **Jasmyn Curry** *(SSP, sole-supervisor, 2024 Sem 1)*
  Spectroscopy of pulsations in RCB stars
- **Josh Ferguson** *(SSP, sole-supervisor, 2024 Sem 1)*
  Dipole mode suppression in the Kepler red giant sample
- **George Feng** *(SSP, co-supervisor, 2024 Sem 1)*
  A red giant in the Pleiades cluster
- **Nikita Nikultsev** *(Honours, sole-supervisor, 2023 Sem 1 & 2)*
  Merging With MESA: Modelling DY Pers by Fusing White Dwarfs
- **Maxwell Bennett** *(Honours, co-supervisor, 2023 Sem 1 & 2)*
  Photometry in Crowded Stellar Fields with NASA's TESS Mission
- **Noah Smith & Nayan Gallego Sivaraman** *(SSP, co-supervisor, 2023 Sem 2)*
  Analysis of the emission from Low Mass X-ray Binary A0620-00 over 6 years
- **Caleb Clark** *(SSP, sole-supervisor, 2023 Sem 1)*
  An automated pipeline to find RCB dust declines
- **Amelie Reid** *(Denison Scholar, co-supervisor, 2023 Summer)*
  Searching the Gaia and TESS data for delta Scuti stars
- **Yifan Chen** *(Dalyell, co-supervisor, 2022 Sem 2)*
  Automated detection and refinement of asteroseismic parameters in 16,000 stars
- **Alexander Jephtha** *(SSP, co-supervisor, 2022 Sem 2)*
  A search for oscillating wide binaries
- **Cameron Davidson** *(SSP, co-supervisor, 2022 Sem 2)*
  Verifying the low-mass Kepler red giants

SERVICE AND LEADERSHIP

SSP Student Telescope Visit September 2025
Committee Member, Trip Supervisor

Leading Teams Workshop 2025
Participant, Nominated by School of Physics

MESA School Leuven June 2025
Teaching Assistant

MESA Down Under Workshop June 2024
Teaching Assistant, Local Organizing Committee

Sydney Institute for Astronomy (SIfA) Seminar Organization Jan 2023-June 2024
Co-organizer

9th Australian Exoplanet Workshop 2023
Local Organizing Committee Member

Physics & Astronomy Graduate Student Organization 2019-2021

President *2020-2021 US Academic Year*
Vice President *2019-2020 US Academic Year*

Astronomy on Tap, Baton Rouge 2018-2022

Emcee, Lead Organizer *2020-2022*
Staff Member *2018-2020*

GRANTS & AWARDS

I am a **co-investigator on an ARC DP**, and was a **co-investigator on 11 telescope proposals and four computing proposals** for a total award of 28 nights of observing time (valued at roughly $235K) and over two million KSU of computing time (valued at roughly $36K).

Grants

- **ARC DP250102562** *2025-2027*
  Decoding Stellar Physics with NASA's James Webb Space Telescope
  Appointed as Co-Investigator to replace Dan Huber

Computing Time

- National Computational Merit Allocation Scheme *2025*
- National Computational Merit Allocation Scheme *2024*
- SIH HPC Allocation Scheme *2024*
- SIH HPC Allocation Scheme *2023*

Telescope Observing Time

- ANU 2.3M/WiFeS *2026*
- ANU 2.3M/WiFeS *2025*
- AAT/Veloce *2024*
- ANU 2.3M/WiFeS *2024*
- Keck/HIRES *2023*
- ANU 2.3M/WiFeS *2023*
- AAT/Veloce Project 1 *Principal Investigator, 2022*
- AAT/Veloce Project 2 *2022*
- ANU 2.3M/WiFeS *2022*
- CTIO/KOSMOS *2019*
- Gemini/NIRI *Principal Investigator, 2017*

REFERENCES

Prof. C. Simon Jeffery simon.jeffery@armagh.ac.uk
Professor

Armagh Observatory and Planetarium,
College Hill, Armagh, UK

Prof. Geoffrey Clayton gclayton@phys.lsu.edu
Ball Family Distinguished Professor

Department of Physics and Astronomy
Louisiana State University

Prof. Timothy Bedding tim.bedding@sydney.edu.au
Professor

Sydney Institute for Astronomy (SIfA), School of Physics,
University of Sydney, NSW 2006, Australia

LIST OF PUBLICATIONS

7 First-Authored Journal Papers

Crawford, C. L., Li, Y., Huber, D., Yu, J., Bedding, T. R., Martell, S. L., Montet, B. T., Stello, D., Isaacson, H., Howard, A. W., Fulton, B. J., Zhang, J., Polanski, A. S. & Weiss, L. M. **The highest mass Kepler red giants – II. Spectroscopic parameters, the amplitude–activity relation, and unexpected halo orbits**. MNRAS **542,** 3289–3301. doi:10.1093/mnras/staf1421. arXiv: 2508.12585 [astro-ph.SR] (Oct. 2025).

Crawford, C. L., Soon, J., Clayton, G. C., Tisserand, P., Bedding, T. R., Clark, C. J. & Lee, C.-U. **A comprehensive study of the dust declines in R Coronae Borealis stars**. MNRAS **537,** 2635–2646. doi:10.1093/mnras/staf215. arXiv: 2412.16393 [astro-ph.SR] (Mar. 2025).

Crawford, C. L., Nikultsev, N., Clayton, G. C., Tisserand, P., Soon, J. & Pedersen, M. G. **Modelling hydrogen-deficient carbon stars in MESA - the effects of total mass and mass ratio**. MNRAS **534,** 1018–1027. doi:10.1093/mnras/stae2149. arXiv: 2408.09700 [astro-ph.SR] (Oct. 2024).

Crawford, C. L., Bedding, T. R., Li, Y., Stello, D., Huber, D., Yu, J., Sreenivas, K. R., Li, T. & Kerrison, E. F. **The highest mass Kepler red giants - I. Global asteroseismic parameters of 48 stars**. MNRAS **528,** 7397–7410. doi:10.1093/mnras/stae473. arXiv: 2402.07380 [astro-ph.SR] (Mar. 2024).

Crawford, C. L., Tisserand, P., Clayton, G. C., Soon, J., Bessell, M., Wood, P., García-Hernández, D. A., Ruiter, A. J. & Seitenzahl, I. R. **A spectral classification system for hydrogen-deficient carbon stars**. MNRAS **521,** 1674–1699. doi:10.1093/mnras/stad324. arXiv: 2210.04416 [astro-ph.SR] (May 2023).

Crawford, C. L., Tisserand, P., Clayton, G. C. & Munson, B. **Peculiar hydrogen-deficient carbon stars: strontium-rich stars and the s-process**. A&A **667,** A85. doi:10.1051/0004-6361/202142882. arXiv: 2112.07689 [astro-ph.SR] (Nov. 2022).

Crawford, C. L., Clayton, G. C., Munson, B., Chatzopoulos, E. & Frank, J. **Modelling R Coronae Borealis stars: effects of He-burning shell temperature and metallicity**. MNRAS **498,** 2912–2924. doi:10.1093/mnras/staa2526. arXiv: 2007.03076 [astro-ph.SR] (Oct. 2020).

14 Co-Authored Journal Papers

Kjeldsen, H., Bedding, T. R., Li, Y., Grundahl, F., Andersen, M. F., Wright, D. J., Soutter, J., Wittenmyer, R., Reyes, C., Stello, D., **Crawford, C.**, Zhou, Y., Clerte, M., Pallé, P. L., Simon-Diaz, S., Christensen-Dalsgaard, J., Handberg, R., Hansen, H., Heeren, P., Jessen-Hansen, J., Lund, M. N., Lundkvist, M. S., Brogaard, K., Tronsgaard, R., Rudrasingam, J., Casagrande, L., Horner, J., Huber, D., Lattanzio, J., Martell, S. L. & Murphy, S. J. **Asteroseismology of the G8 subgiant β Aquilae with SONG-Tenerife, SONG-Australia and TESS**. A&A **700,** A39. doi:10.1051/0004-6361/202554633. arXiv: 2506.00493 [astro-ph.SR] (Aug. 2025).

Mehla, A., Kasliwal, M. M., Karambelkar, V., Tisserand, P., **Crawford, C.**, Clayton, G., Soon, J. & Bhalerao, V. **Oxygen Isotope Ratios in Hydrogen-deficient Carbon Stars: A Correlation with Effective Temperature and Implications for White Dwarf Merger Outcomes**. PASP **137,** 044201. doi:10.1088/1538-3873/adc0bf. arXiv: 2412.03664 [astro-ph.SR] (Apr. 2025).

Sreenivas, K. R., Bedding, T. R., Huber, D., **Crawford, C. L.**, Stello, D., Pedersen, M. G., Li, Y. & Hey, D. **Testing the wavelength dependence of oscillations and granulation in red giants using Kepler and TESS**. MNRAS **537,** 3265–3275. doi:10.1093/mnras/staf220. arXiv: 2502.01899 [astro-ph.SR] (Mar. 2025).

Li, Y., Bedding, T. R., Huber, D., Stello, D., van Saders, J., Zhou, Y., **Crawford, C. L.**, Joyce, M., Li, T., Murphy, S. J. & Sreenivas, K. R. **Realistic Uncertainties for Fundamental Properties of Asteroseismic Red Giants and the Interplay between Mixing Length, Metallicity, and numax**. ApJ **974,** 77. doi:10.3847/1538-4357/ad6c3e. arXiv: 2407.09967 [astro-ph.SR] (Oct. 2024).

Karambelkar, V. R., Kasliwal, M. M., Tisserand, P., Anand, S., Ashley, M. C. B., Bildsten, L., Clayton, G. C., **Crawford, C. C.**, De, K., Earley, N., Hankins, M. J., Hall, X., Lamberts, A., Lau, R. M., McKenna, D., Moore, A., Ofek, E. O., Smith, R. M., Soria, R., Soon, J. & Travouillon, T. **An Infrared Census of R Coronae Borealis Stars II—Spectroscopic Classifications and Implications for the Rate of Low-mass White Dwarf Mergers**. PASP **136,** 084201. doi:10.1088/1538-3873/ad6210. arXiv: 2407.08653 [astro-ph.SR] (Aug. 2024).

Sreenivas, K. R., Bedding, T. R., Li, Y., Huber, D., **Crawford, C. L.**, Stello, D. & Yu, J. **A simple method to measure ν_{max} for asteroseismology: application to 16 000 oscillating Kepler red giants**. MNRAS **530,** 3477–3487. doi:10.1093/mnras/stae991. arXiv: 2401.17557 [astro-ph.SR] (May 2024).

Tisserand, P., **Crawford, C. L.**, Soon, J., Clayton, G. C., Ruiter, A. J. & Seitenzahl, I. R. **HdC and EHe stars through the prism of Gaia DR3. 3D distribution and Gaia's chromatic PSF effects**. A&A **684,** A131. doi:10.1051/0004-6361/202348005. arXiv: 2309.10148 [astro-ph.SR] (Apr. 2024).

Tisserand, P., **Crawford, C. L.**, Soon, J., Clayton, G. C., Ruiter, A. J. & Seitenzahl, I. R. **HdC and EHe stars through the prism of Gaia DR3. Evolution of RV amplitude and dust formation rate with effective temperature**. A&A **684,** A130. doi:10.1051/0004-6361/202348004. arXiv: 2309.10139 [astro-ph.SR] (Apr. 2024).

Read, A. K., Bedding, T. R., Mani, P., Montet, B. T., **Crawford, C.**, Hey, D. R., Li, Y., Murphy, S. J., Pedersen, M. G. & Kruger, J. **Identifying 850 δ Scuti pulsators in a narrow Gaia colour range with TESS 10-min full-frame images**. MNRAS **528,** 2464–2473. doi:10.1093/mnras/stae165. arXiv: 2401.07413 [astro-ph.SR] (Feb. 2024).

Bedding, T. R., Murphy, S. J., **Crawford, C.**, Hey, D. R., Huber, D., Kjeldsen, H., Li, Y., Mann, A. W., Torres, G., White, T. R. & Zhou, G. **TESS Observations of the Pleiades Cluster: A Nursery for δ Scuti Stars**. ApJ **946,** L10. doi:10.3847/2041-8213/acc17a. arXiv: 2212.12087 [astro-ph.SR] (Mar. 2023).

Karambelkar, V., Kasliwal, M. M., Tisserand, P., Clayton, G. C., **Crawford, C. L.**, Anand, S. G., Geballe, T. R. & Montiel, E. **R Coronae Borealis and dustless hydrogen-deficient carbon stars likely have different oxygen isotope ratios**. A&A **667,** A84. doi:10.1051/0004-6361/202142918. arXiv: 2112.07692 [astro-ph.SR] (Nov. 2022).

Tisserand, P., **Crawford, C. L.**, Clayton, G. C., Ruiter, A. J., Karambelkar, V., Bessell, M. S., Seitenzahl, I. R., Kasliwal, M. M., Soon, J. & Travouillon, T. **The dawn of a new era for dustless HdC stars with Gaia eDR3**. A&A **667,** A83. doi:10.1051/0004-6361/202142916. arXiv: 2112.07693 [astro-ph.SR] (Nov. 2022).

Munson, B., Chatzopoulos, E., Frank, J., Clayton, G. C., **Crawford, C. L.**, Denissenkov, P. A. & Herwig, F. **R Coronae Borealis Star Evolution: Simulating 3D Merger Events to 1D Stellar Evolution Including Large-scale Nucleosynthesis**. ApJ **911,** 103. doi:10.3847/1538-4357/abeb6c. arXiv: 2103.01741 [astro-ph.SR] (Apr. 2021).

Kilic, M., Bergeron, P., Dame, K., Hambly, N. C., Rowell, N. & **Crawford, C. L.** **The age of the Galactic stellar halo from Gaia white dwarfs**. MNRAS **482,** 965–979. doi:10.1093/mnras/sty2755. arXiv: 1810.03536 [astro-ph.SR] (Jan. 2019).