Carl Andrew Ziegler

Assistant Professor/Observatory Director

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Research Interests

Characterization of exoplanets; formation and evolution of planetary systems in multiple star systems; large adaptive optics surveys; detection of long-period transiting planets

Positions

September 2020 - current
Stephen F. Austin State University, Nacogdoches, TX
Assistant Professor of Astronomy
Director of SFA Observatory

August 2018 - July 2020
University of Toronto, Toronto, ON
Dunlap Postdoctoral Fellow
PI: SOAR TESS survey (speckle imaging survey)
PI: One Hit Wonders (TESS single-transit planet survey)

Education

May 2018
University of North Carolina, Chapel Hill, NC
PhD, Physics and Astronomy
Thesis: "Characterization of Exoplanets and Stellar Systems with New Robots"
Advisor: Prof. Nicholas Law

August 2013
Southern Illinois University, Carbondale, IL
M.S., Physics
Thesis: "Adsorption of Neon on Open Carbon Nanohorn Aggregates"
Advisor: Prof. Aldo Migone

May 2009
William Jewell College, Liberty, MO
B.A., Physics and Mathematics
Research: variable stars, globular clusters
Advisor: Prof. Maggie Sherer

First or Second Author Publications

8. *SOAR TESS Survey. II: The impact of stellar companions on planetary populations*
C. Ziegler, et al., The Astronomical Journal, 2021 **162** 5

7. *SOAR TESS Survey. I: Sculpting of TESS planetary systems by stellar companions*
C. Ziegler, et al., The Astronomical Journal, 2020 **159** 19

6. *Measuring the Recoverability of Close Binaries in Gaia DR2 with the Robo-AO Kepler Survey*
C. Ziegler, et al., The Astronomical Journal, 2018 **156** 259

5. *Robo-AO Kepler Planetary Candidate Survey V: The effect of physically associated stellar companions on planetary systems*
C. Ziegler, et al., The Astronomical Journal, 2018 **156** 83

First or Second Author Publications – Continued

4. *Robo-AO Kepler Planetary Candidate Survey IV: The effect of nearby stars on 3857 planetary candidate systems*
   C. Ziegler, et al., The Astronomical Journal, 2018 **155** 161
3. *Robo-AO Kepler Planetary Candidate Survey III: Adaptive Optics Imaging of 1629 Kepler Exoplanet Candidate Host Stars*
   C. Ziegler, et al., The Astronomical Journal, 2017 **153** 66
2. *Robo-AO Kepler Planetary Candidate Survey II: Adaptive Optics Imaging of 969 Kepler Exoplanet Candidate Host Stars*
   C. Baranec, C. Ziegler, et al., The Astronomical Journal, 2016 **152** 18
1. *Multiplicity of the Galactic Senior Citizens: A High-resolution Search for Cool Subdwarf Companions*
   C. Ziegler, et al., The Astrophysical Journal, 2015 **804** 30

SPIE Instrumentation Papers

3. *SRAO: the southern robotic speckle + adaptive optics system*
   N. Law, C. Ziegler, A. Tokovinin, Proc. SPIE 9907, Optical and Infrared Interferometry and Imaging V, 99070K, 2016
2. *SRAO: optical design and the dual-knife-edge WFS*
   C. Ziegler, et al., Proc. SPIE 9909, Adaptive Optics Systems V, 99093Z, 2016
1. *The Robo-AO KOI survey: laser adaptive optics imaging of every Kepler exoplanet candidate*
   C. Ziegler, et al., Proc. SPIE 9909, Adaptive Optics Systems V, 99095U, 2016

Talks

Conference Talks

- *SOAR TESS survey: The sculpting of planetary systems by stellar companions*
  AAS 235, January 5-9, Honolulu, HI (2020)
- *One Hit Wonders: Hunting the longest-period TESS planets*
  TESS Sci Con I, July 29-Aug 2, Cambridge, MA (2019)
- *One Hit Wonders: Hunting the longest-period TESS planets*
  CASCA 2019, June 17-20, Montreal, QC (2019)
- *Death Stars? Understanding how tight binaries impact TESS planets with SOAR speckle imaging*
  AAS 233, January 6-10, Seattle, WA (2019)
- *Robo-AO KOI Survey: LGS-AO imaging of every Kepler planetary candidate host star*
  AAS 231, January 9-12, National Harbor, MD (2018)
- *High resolution imaging of 4000 Kepler planetary candidate host stars*
  Know Thy Star, Know Thy Planet, October 11, Pasadena, CA (2017)
- *Robo-AO KOI Survey: LGS-AO imaging of every Kepler planetary candidate host star*
  Transiting Exoplanets, July 17, Keele, UK (2017)
- *Adaptive Optics Imaging of Kepler Planetary Candidates*
  North Carolina Astronomers Meeting, September 24, Jamestown, NC (2016)
- *The Robo-AO KOI Survey: Laser Adaptive Optics Imaging of Every Kepler Exoplanet Candidate*
  AAS 227, January 4-8, Kissimmee, FL (2016)
- *Study of Carbon Dioxide adsorption on Purified HiPco Nanotubes*
  American Physical Society Meeting, March 18–22, Baltimore, MD (2013)

Invited Talks

- *The Robo-AO KOI survey and the development of a Southern robotic AO system*
  Institute for Astronomy, September 14, Hilo, Hawaii (2016)

Conference Posters

- *One Hit Wonders: recovering the longest period TESS planets*
  C. Ziegler, et al., Extreme Solar Systems IV, Reykyavik, Iceland (2019)
- *Sculpting of TESS Planetary Systems by Binary Stars*
  C. Ziegler, et al., Tess SciCon I, Cambridge, MA (2019)
- *Robo-AO KOI Survey: Robotic LGS-AO Imaging of Every Kepler Planetary Candidate*
  C. Ziegler, et al., Kepler SciCon IV, NASA Ames (2017)
- *SRAO: the first southern robotic AO system*
  C. Ziegler, et al., SPIE Astronomical Telescopes + Instrumentation, Edinburgh, UK (2016)
- *The Robo-AO KOI survey: laser adaptive optics imaging of every Kepler exoplanet candidate*
  C. Ziegler, et al., SPIE Astronomical Telescopes + Instrumentation, Edinburgh, UK (2016)
- *Multiplicity of the Galactic Senior Citizens: A high-resolution search for cool subdwarf companions*
  C. Ziegler & N. Law, AAS 225, Seattle, WA (2015)

Teaching Experience

Fall 2019	**University of Toronto**, Toronto, ON *Exoplanet mini-course, AST 221* Taught 8-week course on detection of exoplanets and exoplanet demographics to Astronomy majors. Mix of lectures an in-class group projects.
Summer 2019	**University of Toronto**, Toronto, ON *AO Lab Lead, Dunlap Summer School* Led both undergraduates and graduate students in a lecture introducing adaptive optics and a lab to build a Shack-Hartmann wavefront sensor.
Summer 2019	**University of Toronto**, Toronto, ON *Summer Undergraduate Mentor* Advised summer undergraduate student in testing and implementing robotic telescope control and on-the-fly data reduction pipeline.
Spring 2017	**University of North Carolina**, Chapel Hill, NC *Undergraduate Research Mentor* Advised capstone course for UNC undergraduate to build novel methods to reduce adaptive optics images of bright stars
Summer 2015	**University of North Carolina**, Chapel Hill, NC *Summer Research Mentor* Advised high school student with *Kepler* host star multiplicity research

Teaching Experience - Continued

Fall 2013- Spring 2014	**University of North Carolina**, Chapel Hill, NC *Astronomy 101L Lab Teaching Assistant* Led five lab sections using robotic "Skynet" telescopes
Fall 2010- Spring 2013	**Southern Illinois University**, Carbondale, IL *Astronomy 101 Lab Teaching Assistant* Taught twenty lab sections in astronomy
Spring 2012- Fall 2012	**Southern Illinois University**, Carbondale, IL *Physics Lab Instructor* Taught three calculus-based physics lab courses

Professional Service and Public Outreach

- Referee for MNRAS, ApJ, AJ, PASP, and A&A
- Assisted monthly public observing nights for Chapel Hill Astronomical and Observational Society
- Two public talks for Raleigh Astronomy Club

Sofware Skills

Computer Programming:	- Python (primary language for astronomical data analysis) - C++ (control software for Andor EMCCD camera, WFS reconstruction) - TheSkyX (automated telescope and observatory control) - MaximDL (camera control and reduction) - Mathematica (hydrodymical simulations for graduate ISM class) - HTML (designed project sites, `roboaokepler.org` and `onehitwonders.space`) - LabVIEW (wrote control GUI for gas adsorption instrumentation) - Mathematica (hydrodymical simulations for graduate ISM class)

Instrumentation

Instrumentation Design:	- Zemax (optical design for Robo-SOAR) - SolidWorks (modeling for fabrication of custom mounts and packaging used in Robo-SOAR)
Robo-SOAR construction:	- built optical testbed of NGS-AO system - designed and constructed prototype of reflective pyramid WFS

Professional References

Professor Suresh Sivanandam
Assistant Professor, Dunlap Institute for Astronomy, University of Toronto
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Professor Nicholas Law
Assistant Professor, Department of Astronomy, University of North Carolina
nlaw@unc.edu / 919-962-3019

Professor Christoph Baranec
Assistant Astronomer, Institute for Astronomy, University of Hawaii, Manoa
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Professor Adam Kraus
Assistant Professor, Department of Astronomy, University of Texas, Austin
alk@astro.as.utexas.edu / 617-956-7740

All Peer-reviewed Articles

[109] D. del Ser et al. *TFAW survey II: six newly validated planets and 13 planet candidates from K2*. In: Monthly Newsletter of the Royal Astronomical Society **518**.1 (2023), pp. 669–690. arXiv: 2210.10805 [astro-ph.EP].

[108] Mohammed El Mufti et al. *TOI 560: Two Transiting Planets Orbiting a K Dwarf Validated with iSHELL, PFS, and HIRES RVs*. In: The Astronomical Journal **165**.1, 10 (2023), p. 10.

[107] Christian Magliano et al. *A systematic validation of hot Neptunes in TESS data*. In: Monthly Newsletter of the Royal Astronomical Society **519**.1 (2023), pp. 1562–1577. arXiv: 2211.08490 [astro-ph.EP].

[106] Priyashkumar Mistry et al. *VaTEST II: Statistical Validation of 16 Exoplanets of TESS*. In: arXiv e-prints, arXiv:2301.09865 (2023), arXiv:2301.09865. arXiv: 2301.09865 [astro-ph.EP].

[105] Dominic Oddo et al. *Characterization of a set of small planets with TESS and CHEOPS and an analysis of photometric performance*. In: arXiv e-prints, arXiv:2301.08162 (2023), arXiv:2301.08162. arXiv: 2301.08162 [astro-ph.EP].

[104] Evan Tey et al. *TESS Discovery of Twin Planets near 2:1 Resonance around Early M-Dwarf TOI 4342*. In: arXiv e-prints, arXiv:2301.01370 (2023), arXiv:2301.01370. arXiv: 2301.01370 [astro-ph.EP].

[103] Benjamin M. Tofflemire et al. *A Low-mass, Pre-main-sequence Eclipsing Binary in the 40 Myr Columba Association-Fundamental Stellar Parameters and Modeling the Effect of Star Spots*. In: The Astronomical Journal **165**.2, 46 (2023), p. 46. arXiv: 2210.10789 [astro-ph.SR].

[102] Noah Vowell et al. *HIP 33609 b: An Eccentric Brown Dwarf Transiting a V=7.3 Rapidly Rotating B-Star*. In: arXiv e-prints, arXiv:2301.09663 (2023), arXiv:2301.09663. arXiv: 2301.09663 [astro-ph.EP].

[101] J. M. Almenara et al. *GJ 3090 b: one of the most favourable mini-Neptune for atmospheric characterisation*. In: Astronomy & Astrophysics **665**, A91 (2022), A91. arXiv: 2207.14121 [astro-ph.EP].

[100] O. Barragán et al. *The young HD 73583 (TOI-560) planetary system: two 10-$M_\oplus$ mini-Neptunes transiting a 500-Myr-old, bright, and active K dwarf*. In: Monthly Newsletter of the Royal Astronomical Society **514**.2 (2022), pp. 1606–1627. arXiv: 2110.13069 [astro-ph.EP].

[99] Luca Cacciapuoti et al. *TESS discovery of a super-Earth and two sub-Neptunes orbiting the bright, nearby, Sun-like star HD 22946*. In: Astronomy & Astrophysics **668**, A85 (2022), A85. arXiv: 2209.09597 [astro-ph.EP].

[98] Sam Christian et al. *A Possible Alignment Between the Orbits of Planetary Systems and their Visual Binary Companions*. In: The Astronomical Journal **163**.5, 207 (2022), p. 207. arXiv: 2202.00042 [astro-ph.EP].

[97] Jessie L. Christiansen et al. *Scaling K2. V. Statistical Validation of 60 New Exoplanets From K2 Campaigns 2-18*. In: The Astronomical Journal **163**.6, 244 (2022), p. 244. arXiv: 2203.02087 [astro-ph.EP].

[96] Jiayin Dong et al. *NEID Rossiter-McLaughlin Measurement of TOI-1268b: A Young Warm Saturn Aligned with Its Cool Host Star*. In: The Astrophysical Journall **926**.2, L7 (2022), p. L7. arXiv: 2201.12836 [astro-ph.EP].

[95] Georgina Dransfield et al. *HD 28109 hosts a trio of transiting Neptunian planets including a near-resonant pair, confirmed by ASTEP from Antarctica*. In: Monthly Newsletter of the Royal Astronomical Society **515**.1 (2022), pp. 1328–1345. arXiv: 2205.09046 [astro-ph.EP].

[94] Steven Giacalone et al. *HD 56414 b: A Warm Neptune Transiting an A-type Star*. In: The Astrophysical Journall **935**.1, L10 (2022), p. L10. arXiv: 2208.06396 [astro-ph.EP].

[93] Steven Giacalone et al. *Validation of 13 Hot and Potentially Terrestrial TESS Planets*. In: The Astronomical Journal **163**.2, 99 (2022), p. 99. arXiv: 2201.12661 [astro-ph.EP].

[92] Alexis Heitzmann et al. *TOI-4562 b: A highly eccentric temperate Jupiter analog orbiting a young field star*. In: arXiv e-prints, arXiv:2208.10854 (2022), arXiv:2208.10854. arXiv: 2208.10854 [astro-ph.EP].

[91] Benjamin J. Hord et al. *The Discovery of a Planetary Companion Interior to Hot Jupiter WASP-132 b*. In: The Astronomical Journal **164**.1, 13 (2022), p. 13. arXiv: 2205.02501 [astro-ph.EP].

[90] Zitao Lin et al. *Three low-mass companions around aged stars discovered by TESS*. In: arXiv e-prints, arXiv:2210.13939 (2022), arXiv:2210.13939. arXiv: 2210.13939 [astro-ph.SR].

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[87] Carina M. Persson et al. *TOI-2196 b: Rare planet in the hot Neptune desert transiting a G-type star*. In: Astronomy & Astrophysics **666**, A184 (2022), A184. arXiv: 2208.05797 [astro-ph.EP].

[86] Joseph E. Rodriguez et al. *Another Shipment of Six Short-Period Giant Planets from TESS*. In: arXiv e-prints, arXiv:2205.05709 (2022), arXiv:2205.05709. arXiv: 2205.05709 [astro-ph.EP].

[85] Maıssa Salama et al. *An Adaptive Optics Census of Companions to Northern Stars Within 25 pc with Robo-AO*. In: The Astronomical Journal **163**.5, 200 (2022), p. 200. arXiv: 2203.11250 [astro-ph.SR].

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[83] Lizhou Sha et al. *TESS spots a mini-neptune interior to a hot saturn in the TOI-2000 system*. In: arXiv e-prints, arXiv:2209.14396 (2022), arXiv:2209.14396. arXiv: 2209.14396 [astro-ph.EP].

[82] Sydney Vach et al. *TOI-712: A System of Adolescent Mini-Neptunes Extending to the Habitable Zone*. In: The Astronomical Journal **164**.2, 71 (2022), p. 71. arXiv: 2111.02416 [astro-ph.EP].

[81] Mackenna L. Wood et al. *TESS Hunt for Young and Maturing Exoplanets (THYME) IX: a 27 Myr extended population of Lower-Centaurus Crux with a transiting two-planet system*. In: arXiv e-prints, arXiv:2212.03266 (2022), arXiv:2212.03266. arXiv: 2212.03266 [astro-ph.SR].

[80] Samuel W. Yee et al. *The TESS Grand Unified Hot Jupiter Survey. I. Ten TESS Planets*. In: The Astronomical Journal **164**.2, 70 (2022), p. 70. arXiv: 2205.09728 [astro-ph.EP].

[79] Samuel W. Yee et al. *The TESS Grand Unified Hot Jupiter Survey. II. Twenty New Giant Planets*. In: arXiv e-prints, arXiv:2210.15473 (2022), arXiv:2210.15473. arXiv: 2210.15473 [astro-ph.EP].

[78] Elisabeth R. Adams et al. *Ultra-short-period Planets in K2. III. Neighbors are Common with 13 New Multiplanet Systems and 10 Newly Validated Planets in Campaigns 0-8 and 10*. In: Planetary Society Journal **2**.4, 152 (2021), p. 152. arXiv: 2011.11698 [astro-ph.EP].

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[76] Jennifer A. Burt et al. *TOI-1231 b: A Temperate, Neptune-sized Planet Transiting the Nearby M3 Dwarf NLTT 24399*. In: The Astronomical Journal **162**.3, 87 (2021), p. 87. arXiv: 2105.08077 [astro-ph.EP].

[75] Theron W. Carmichael et al. *TOI-811b and TOI-852b: New Transiting Brown Dwarfs with Similar Masses and Very Different Radii and Ages from the TESS Mission*. In: The Astronomical Journal **161**.2, 97 (2021), p. 97. arXiv: 2009.13515 [astro-ph.SR].

[74] M. Cointepas et al. *TOI-269 b: an eccentric sub-Neptune transiting a M2 dwarf revisited with ExTrA*. In: Astronomy & Astrophysics **650**, A145 (2021), A145. arXiv: 2104.14782 [astro-ph.EP].

[73] Rebekah I. Dawson et al. *Precise Transit and Radial-velocity Characterization of a Resonant Pair: The Warm Jupiter TOI-216c and Eccentric Warm Neptune TOI-216b*. In: The Astronomical Journal **161**.4, 161 (2021), p. 161. arXiv: 2102.06754 [astro-ph.EP].

[72] Tansu Daylan et al. *TESS Discovery of a Super-Earth and Three Sub-Neptunes Hosted by the Bright, Sun-like Star HD 108236*. In: The Astronomical Journal **161**.2, 85 (2021), p. 85. arXiv: 2004.11314 [astro-ph.EP].

[71] Mohammed El Mufti et al. *TOI 560 : Two Transiting Planets Orbiting a K Dwarf Validated with iSHELL, PFS and HIRES RVs*. In: arXiv e-prints, arXiv:2112.13448 (2021), arXiv:2112.13448. arXiv: 2112.13448 [astro-ph.EP].

[70] Tianjun Gan et al. *HD 183579b: a warm sub-Neptune transiting a solar twin detected by TESS*. In: Monthly Newsletter of the Royal Astronomical Society **507**.2 (2021), pp. 2220–2240. arXiv: 2107.14015 [astro-ph.EP].

[69] R. Luque et al. *A planetary system with two transiting mini-Neptunes near the radius valley transition around the bright M dwarf TOI-776*. In: Astronomy & Astrophysics **645**, A41 (2021), A41. arXiv: 2009.08338 [astro-ph.EP].

[68] David V. Martin et al. *TOI-1259Ab - a gas giant planet with 2.7 per cent deep transits and a bound white dwarf companion*. In: Monthly Newsletter of the Royal Astronomical Society **507**.3 (2021), pp. 4132–4148. arXiv: 2101.02707 [astro-ph.EP].

[67] Kristo Ment et al. *TOI 540 b: A Planet Smaller than Earth Orbiting a Nearby Rapidly Rotating Low-mass Star*. In: The Astronomical Journal **161**.1, 23 (2021), p. 23. arXiv: 2009.13623 [astro-ph.EP].

[66] C. Moutou et al. *TOI-1296b and TOI-1298b observed with TESS and SOPHIE: two hot Saturn-mass exoplanets with different densities around metal-rich stars*. In: Astronomy & Astrophysics **653**, A147 (2021), A147. arXiv: 2109.09252 [astro-ph.EP].

[65] Elisabeth R. Newton et al. *TESS Hunt for Young and Maturing Exoplanets (THYME). IV. Three Small Planets Orbiting a 120 Myr Old Star in the Pisces-Eridanus Stream*. In: The Astronomical Journal **161**.2, 65 (2021), p. 65. arXiv: 2102.06049 [astro-ph.EP].

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[61] Lizhou Sha et al. *TOI-954 b and K2-329 b: Short-period Saturn-mass Planets that Test whether Irradiation Leads to Inflation*. In: The Astronomical Journal **161**.2, 82 (2021), p. 82. arXiv: 2010.14436 [astro-ph.EP].

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[57] Carl Ziegler et al. *Robo-AO and SOAR High-resolution Surveys of Exoplanet Hosting Stars*. In: Frontiers in Astronomy and Space Sciences **8**, 3 (2021), p. 3.

[56] Carl Ziegler et al. *SOAR TESS Survey. II. The Impact of Stellar Companions on Planetary Populations*. In: The Astronomical Journal **162**.5, 192 (2021), p. 192. arXiv: 2103.12076 [astro-ph.EP].

[55] David J. Armstrong et al. *A remnant planetary core in the hot-Neptune desert*. In: Nature **583**.7814 (2020), pp. 39–42. arXiv: 2003.10314 [astro-ph.EP].

[54] N. Astudillo-Defru et al. *A hot terrestrial planet orbiting the bright M dwarf L 168-9 unveiled by TESS*. In: Astronomy & Astrophysics **636**, A58 (2020), A58. arXiv: 2001.09175 [astro-ph.EP].

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[52] Rafael Brahm et al. *TOI-481 b and TOI-892 b: Two Long-period Hot Jupiters from the Transiting Exoplanet Survey Satellite*. In: The Astronomical Journal **160**.5, 235 (2020), p. 235. arXiv: 2009.08881 [astro-ph.EP].

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[50] Ryan Cloutier et al. *A Pair of TESS Planets Spanning the Radius Valley around the Nearby Mid-M Dwarf LTT 3780*. In: The Astronomical Journal **160**.1, 3 (2020), p. 3. arXiv: 2003.01136 [astro-ph.EP].

[49] Jason Lee Curtis et al. *When Do Stalled Stars Resume Spinning Down? Advancing Gyrochronology with Ruprecht 147*. In: The Astrophysical Journal **904**.2, 140 (2020), p. 140. arXiv: 2010.02272 [astro-ph.SR].

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[41] James S. Jenkins et al. *Author Correction: An ultrahot Neptune in the Neptune desert*. In: Nature Astronomy **4** (2020), pp. 1202–1202.
[40] Andrés Jordán et al. *TOI-677b: A Warm Jupiter (P = 11.2 days) on an Eccentric Orbit Transiting a Late F-type Star*. In: The Astronomical Journal **159**.4, 145 (2020), p. 145. arXiv: 1911.05574 [astro-ph.EP].
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