William J. Oldroyd

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EDUCATION

Northern Arizona University (NAU) Aug 2018 – Present
Astronomy and Planetary Science, PhD Flagstaff, AZ
GPA: 4.0

Brigham Young University (BYU) Aug 2010 – Apr 2018
Physics-Astronomy, BS Provo, UT
Minors: Mathematics, Spanish, Geology
GPA: 3.6

SCHOLARSHIPS, GRANTS, AND AWARDS

- NAU Graduate Student Government Poster Symposium Competition, 2nd Place Poster 2021
- NAU Graduate Student Government Conference Presentation Competition Session Winner 2021
- NAU Astronomy and Planetary Science Graduate Student Grant 2020
- American Astronomical Society Division for Planetary Sciences Hartmann Student Travel Grant 2020
- American Astronomical Society Division on Dynamical Astronomy Student Registration Grant 2020
- NAU Physics and Astronomy Graduate Student Travel Grant 2019
- NAU 3 Minute Research Presentation "Most Surprising Research"/Peoples' Choice Award 2019
- Robert Squires Scholarship 2017-2018
- BYU Office of Research and Creative Activities Student Research Grant 2016-2017
- Doyle C. and Sandra J. Udy Scholarship 2016-2017
- BYU Physics Departmental Scholarship 2016-2017
- BYU General Scholarships, 2010-2011, 2015-2016
- BYU ROC Band Scholarship 2015
- Cheri de Bonneville Scholarship 2011-2012, 2014
- BYU Marching Band Scholarship 2010-2011, 2014

PUBLICATIONS

Refereed (2)

- **Oldroyd, William J.**; Trujillo, Chadwick A., "Outer Solar System Perihelion Gap Formation Through Interactions with a Hypothetical Distant Giant Planet," The Astronomical Journal, Vol. 162, Issue 2, id.39, August 2021
- Chandler, Colin Orion; Kueny, Jay K.; Trujillo, Chadwick A.; Trilling, David E.; **Oldroyd, William J.**, "Cometary Activity Discovered on a Distant Centaur: A Non-Aqueous Sublimation Mechanism," The Astrophysical Journal Letters, Vol. 892, No. 2, L38, April 2020

Non-Refereed (22)

- **Oldroyd, W. J.**; Trujillo, C. A., "Planet X Can Cause the Outer Solar System Perihelion Gap," American Astronomical Society, Division on Dynamical Astronomy meeting #52 id. 502.04, June 2021
- **Oldroyd, W.**; Robinson, T., "Maximizing Orbital Constraints for Directly Imaged Exoplanets," American Astronomical Society meeting #237, id. 516.03, January 2021
- Michael S. P. Kelly; Henry H. Hsieh; Colin Orion Chandler; Siegfried Eggl; Timothy R. Holt; Lynne Jones; Mario Jurić; Timothy A. Lister; Joachim Moeyens; **William J. Oldroyd**; Darin Ragozzine; and David E. Trilling, "Community Challenges in the Era of Petabyte-Scale Sky Surveys," Planetary Science and Astrobiology Decadal Survey 2023-2032 White Paper; Bulletin of the American Astronomical Society, Vol. 53, Issue 4, e-id. 495, May 2021 & arXiv:2011.03584, November 2020

- **Oldroyd, W. J.**; Trujillo, C. A., "Outer Solar System Perihelion Gap Formation through Perturbations from an Undiscovered Giant Planet," American Astronomical Society, Division of Planetary Science meeting #52, id.304.04, October 2020
- Chandler, C. O.; Kueny, J. K.; Trujillo, C. A.; Trilling, D. E.; **Oldroyd, W. J.**, "Cometary Activity Discovered on Centaur 2014 OG392," American Astronomical Society, Division of Planetary Science meeting #52, id.404.02, October 2020
- Vera C. Rubin Observatory LSST Solar System Science Collaboration; R. Lynne Jones; Michelle T. Bannister; Bryce T. Bolin; Colin Orion Chandler; Steven R. Chesley; Siegfried Eggl; Sarah Greenstreet; Timothy R. Holt; Henry H. Hsieh; Željko Ivezić; Mario Jurić; Michael S. P. Kelly; Matthew M. Knight; Renu Malhotra; **William J. Oldroyd**; Gal Sarid; Megan E. Schwamb; Colin Snodgrass; Michael Solontoi; and David E. Trilling, "The Scientific Impact of the Vera C. Rubin Observatory's Legacy Survey of Space and Time (LSST) for Solar System Science," Planetary Science and Astrobiology Decadal Survey 2023-2032 White Paper; Bulletin of the American Astronomical Society, Vol. 53, Issue 4, e-id. 236, May 2021 & arXiv:2009.07653, September 2020
- **Oldroyd, W. J.**; Trujillo, C. A., "Constraining the Outer Solar System Perihelion Gap," American Astronomical Society, Division on Dynamical Astronomy meeting #51, id.501.04, August 2020
- **Oldroyd, W. J.**; Robinson, T., "Orbital Solutions for Revisit Optimization of Directly Imaged Exoplanets," American Astronomical Society meeting #235, id. 320.04, January 2020
- Chad Trujillo; David Trilling; David Gerdes; Matthew Holman; Larissa Markwardt; Scott Sheppard; Cesar Fuentes; Mario Juric; Edward Lin; Andrew McNeill; Michael Mommert; **William Oldroyd**; Matthew Payne; Darin Ragozzine; Andrew Rivkin; Hilke Schlichting; and Megan Schwamb, "Deep Ecliptic Exploration Project (DEEP) Observing Strategy," EPSC Abstracts Vol. 13, EPSC-DPS2019-2070, September 2019
- **William Oldroyd** and Chadwick Trujillo, "The Outer Solar System Perihelion Gap," EPSC Abstracts Vol. 13, EPSC-DPS2019-1255-1, September 2019
- David Trilling; David Gerdes; Chad Trujillo; Scott Sheppard; Cesar Fuentes; Hilke Schlichting; Andrew McNeill; Mario Juric; Matt Holman; Ed Lin; Larissa Markwardt; Michael Mommert; **William Oldroyd**; Matt Payne; Darin Ragozzine; Andrew Rivkin; and Megan Schwamb, "The Deep Ecliptic Exploration Project (DEEP): A new NOAO survey of the faint outer Solar System," EPSC Abstracts Vol. 13, EPSC-DPS2019-395-1, September 2019
- **Oldroyd, William Jared**; Trujillo, Chad, "Computationally and Observationally Constraining the Outer Solar System Perihelion Gap to Help Find Planet X," American Astronomical Society Division on Dynamical Astronomy meeting #50, id.201.01, June 2019
- Trujillo, C. A.; Sheppard, S. S.; **Oldroyd, W. J.**, "2017 VO34," Minor Planet Electronic Circular, No. 2019-F101, March 2019
- Sheppard, S. S.; Trujillo, C. A.; **Oldroyd, W. J.**; Tholen, D. J., "2018 AX18," Minor Planet Electronic Circular, No. 2019-C98, February 2019
- Trujillo, C. A.; Sheppard, S. S.; Thirouin, A.; **Oldroyd, W. J.**, "2017 WH30," Minor Planet Electronic Circular, No. 2019-C97, February 2019
- Sheppard, S. S.; Trujillo, C. A.; **Oldroyd, W. J.**; Tholen, D. J., "2017 SN132," Minor Planet Electronic Circular, No. 2019-C96, February 2019
- Trujillo, C. A.; Sheppard, S. S.; **Oldroyd, W. J.**; Tholen, D. J.; Thirouin, A., "2017 OG69," Minor Planet Electronic Circular, No. 2019-C95, February 2019
- Sheppard, S. S.; Trujillo, C. A.; **Oldroyd, W. J.**; Tholen, D. J.; Williams, G. V., "2018 VG18," Minor Planet Electronic Circular, No. 2018-Y14, December 2018
- **Oldroyd, William Jared**; Ragozzine, Darin; Porter, Simon, "More Sophisticated Fits of the Orbits of

Haumea's Interacting Moons," American Astronomical Society, Division on Dynamical Astronomy meeting #49, id. 402.03, April 2018

- **Oldroyd, W. J.**; Radebaugh, J.; Stephens, D.; Lorenz, R. D.; Harvey, R. P.; Karner, J., "Modeling Meteorite Heat Transfer in an Antarctic Environment," 49th Lunar and Planetary Science Conference, LPI Contribution No. 2083, id.2794, March 2018
- **Oldroyd, W. J.**; Radebaugh, J.; Stephens, D. C.; Lorenz, R.; Harvey, R.; Karner, J., "Modeling the Thermal Interactions of Meteorites Below the Antarctic Ice," American Astronomical Society, Division of Planetary Science meeting #49, id.113.01, October 2017
- **Oldroyd, W. J.**; Radebaugh, J, "Searching for a Hidden Population of Iron Meteorites Below the Antarctic Ice," 48th Lunar and Planetary Science Conference, LPI Contribution No. 1964, id.2967, March 2017

RESEARCH EXPERIENCE

NAU Graduate Research Aug 2018 – Present

Computationally and Observationally Constraining the Outer Solar System Perihelion Gap Flagstaff, AZ

- Modeled the gravitational effects of Planet X on the structure of the outer solar system using N-body integrations on NAU's High Performance Computing Cluster, Monsoon
- Utilized a variety of statistical tests and modeling techniques to calculate the significance of the observed dearth of objects in the region termed the "gap"
- Recovered newly discovered outer solar system objects using the Large Monolithic Imager on the Lowell Observatory 4.3m Lowell Discovery Telescope in Arizona and the Inamori Magellan Areal Camera and Spectrograph on the Las Campanas Observatory 6.5m Walter Baade Magellan Telescope in Chile
- Presented at the Flagstaff Astronomy Symposium Spring 2019, NAU Graduate Student Government Poster Symposium 2019, NAU 3 Minute Research Presentation Competition Finals 2019, the American Astronomical Society Division on Dynamical Astronomy meeting 2019, the European Planetary Science Congress/American Astronomical Society Division of Planetary Science joint meeting 2019, the Northern Arizona Planetary Science Alliance STEM poster session 2019, the Prescott Astronomy Club October 2019, the Western Association of Graduate Schools Regional 3 Minute Thesis Competition 2020, the American Astronomical Society Division on Dynamical Astronomy virtual meeting 2020, the Saguaro and East Valley Astronomy Clubs September 2020, the American Astronomical Society Division of Planetary Science virtual meeting 2020, the Flagstaff Festival of Science 2020, the West Valley Astronomy Club February 2021, the Phoenix Astronomical Society March 2021, the NAU Graduate Student Government Poster Symposium Conference and Competition March 2021, and Efígie Educação E Cultrua Mock Class May 2021

NAU Graduate Research Sep 2018 – Present

Deep Ecliptic Exploration Project (DEEP) Flagstaff, AZ

- Team member on the largest outer solar system survey to date
- Assisted in project proposal, observational planning, project design, and remote observations with the wide field Dark Energy Camera on the 4m Víctor Blanco Telescope at the Cerro Tololo Inter-American Observatory in Chile

NAU Graduate Research Dec 2018 – Present

Orbital Solutions for Revisit Optimization of Directly Imaged Exoplanets Flagstaff, AZ

- Developed a model for maximizing the efficiency for orbital determination of directly imaged exoplanets using N-body integration and Markov Chain Monte Carlo statistical sampling methods
- Presented at the American Astronomical Society 2020 and 2021 Winter meetings

NAU Graduate Research Dec 2018 – Present

Constraining the Space Weathering Rate with Asteroid Family Spectral Slope Modeling Flagstaff, AZ

- Modeled space weathering effects on asteroid families using Markov Chain Monte Carlo statistical sampling methods on NAU's High Performance Computing Cluster, Monsoon
- Mentored an NAU Summer Research Experience for Undergraduates intern

NAU Graduate Research Apr 2020 – Present

Searching for Surface Features using Color Variegation on Large Trans-Neptunian Objects Flagstaff, AZ

- Observed large Trans-Neptunian Objects using the 2 x 8.4m Large Binocular Telescope searching for hemispherical color differences

Other Graduate Research Oct 2019 – Present

Legacy Survey of Space and Time Solar System Science Collaboration

- Team member and member of the Outer Solar System, Inner Solar System, Active Objects, and Community Software/Infrastructure Development working groups
- Local host for Virtual Solar System Readiness Sprint workshop
- Co-authored two White Papers submitted to the Planetary Science and Astrobiology Decadal Survey 2023-2032
- Assisted in determining solar system observing cadence recommendations for the Vera C. Rubin Observatory Survey Cadence Optimization Committee

BYU Undergraduate Senior Thesis Dec 2014 – Apr 2018

Modeling the Thermal Interactions of Meteorites Below the Antarctic Ice Provo, UT

- Analyzed solar flux and temperature data recorded in Antarctica
- Created thermal interaction models using Matlab
- Presented at the Lunar and Planetary Science Conference 2017 & 2018, BYU Student Research Conference 2017 & 2018, and the American Astronomical Society Division of Planetary Science meeting 2017

BYU Undergraduate Research Jul 2017 – Aug 2018

Modeling the Orbital Parameters of the Haumea System Provo, UT

- Modified and updated existing Python code to account for previously omitted physics
- Utilized Markov Chain Monte Carlo integration to find least squares fits for orbital parameters
- Analyzed results for consistency with Hubble Space Telescope data
- Presented at the American Astronomical Society Division of Dynamical Astronomy meeting 2018

BYU Undergraduate Research Dec 2014 – Apr 2018

Using Modeling to Improve Methods for Teaching Electrostatics to Non-Physics Majors Provo, UT

- Developed and tested physical models for visually representing electrostatics principles
- Presented at regional American Association of Physics Teachers meetings 2016 and 2017

TEACHING EXPERIENCE

NAU Interns to Scholars Program Jan 2020 – Present

Mentor Flagstaff, AZ

- Co-mentored a beginning undergraduate in a hands on computational research project focused on searching for exoplanets in data from NASA's Transiting Exoplanet Survey Satellite mission

TRiO Upward Bound NAU Summer Residential Program Jul 2020 & July 2021
Instructor Flagstaff, AZ

- Developed curriculum for and taught courses on Solar System Exploration and Planet Detection Techniques to classes of high school students from diverse backgrounds, cultures and academic levels

TRiO Upward Bound South Mountain Community College Saturday Academy Jan 2021 – May 2021
Instructor Phoenix, AZ

- Developed curriculum for and taught an Applied Physics course to a class of high school students from diverse backgrounds cultures and academic levels who are potential first generation college students

NAU Summer Research Experience for Undergraduates Jun 2020 – Aug 2020
Mentor Flagstaff, AZ

- Co-mentored a upper level undergraduate on Constraining the Space Weathering Rate with Asteroid Family Spectral Slope Modeling using NAU's *Monsoon* High Performance Computing Cluster

BYU Department of Physics and Astronomy Dec 2014 – Dec 2017
Teaching Assistant Provo, UT

- Assisted students in walk-in laboratory with 100-500 level physics labs
- Taught a section of Physics 107: a non-physics major lab class
- Assisted students in Physics 329: an upper level observational astronomy class with data reduction and analysis using IRAF and AstroImageJ

Private High School Physics Tutor Sep 2016 – Dec 2016
Physics Tutor Provo, UT

- Assisted a student with conceptual understanding and homework

OUTREACH PRESENTATIONS

- Efigie Educação E Cultrua (Brazil) Mock Class Program, May 10, 2021, "How to Discover a Planet"
- Phoenix Astronomical Society, Mar 4, 2021, "The Search for Planet X"
- West Valley Astronomy Club, Feb 2, 2021, "The Search for Planet X"
- Flagstaff Festival of Science In-School Speaker Program, Oct 22, 2020, "A Hidden Planet in our Solar System"
- Saguaro Astronomy Club & East Valley Astronomy Club, Sep 4, 2020, "The Search for Planet X"
- Prescott Astronomy Club, Oct 17, 2019, "Exploring the Gap Beyond the Kuiper Belt: Implications for Planet X"

ASTRONOMY SERVICE

- American Astronomical Society Chambliss Astronomy Achievement Student Awards Poster Competition Judge at the AAS Winter 2021 meeting
- NAU Astronomy and Planetary Science Fellowship Mock Review Panel Panelist Jan 2019, 2020, and 2021
- Local Host for Legacy Survey of Space and Time Solar System Science Collaboration Virtual Solar System Readiness Sprint Conference Jun 2020

TELESCOPE OBSERVING EXPERIENCE

- Large Binocular Cameras (Red and Blue), 2 x 8.4m Large Binocular Telescope, Large Binocular Telescope Observatory, Arizona, USA, remote queue
- Inamori Magellan Areal Camera and Spectrograph, 6.5m Walter Baade Magellan Telescope, Las Campanas Observatory, Chile, on site and remote
- Large Monolithic Imager, 4.3m Lowell Discovery Telescope, Lowell Observatory, Arizona, USA, on site and remote
- Dark Energy Camera, 4m Víctor Blanco Telescope, Cerro Tololo Inter-American Observatory, Chile, remote
- 0.5m Barry Lutz Telescope, Atmospheric Research Observatory, Northern Arizona University, Arizona, USA, on site
- 0.4m David Derrick Telescope, Orson Pratt Observatory, Brigham Young University, Utah, USA, on site

HIGH PERFORMANCE COMPUTING AND PROGRAMMING EXPERIENCE

- Utilized over 1.3 million compute hours on the NAU High Performance Computing Cluster, *Monsoon*, for orbital dynamics simulations, space weathering models, exoplanet lightcurve extraction, and parallel computing metric testing
- Programming languages used in research: python, C/C++, bash, IDL, MATLAB, VBA, Mathematica

OTHER WORK, EXTRACURRICULAR, AND VOLUNTEER EXPERIENCE

NAU Department of Astronomy and Planetary Science Grad Student Club Oct 2020 – Present
Vice President Flagstaff, AZ

- Assisted in organizing/founding the club
- Coordinated club events and awards
- Maintained club constitution and other organizing documents

Volunteer Boy Scout Leader Dec 2004 – Dec 2018
Cub Scout Committee Member, Assistant Scoutmaster, Senior Patrol Leader Provo, UT

- Assisted Cub Scouts in earning awards and progressing through the program
- Merit Badge Counselor for Chess and Astronomy
- Leadership instructor for National Youth Leadership Training
- Organized and staffed leadership training camps
- Eagle Scout - Dec 3, 2006
- Varsity Scout Denali Award (Eagle Equivalent for Varsity Scouts)

BYU Astronomy Research Group Sep 2016 – Dec 2016
Group Leader Provo, UT

- Planned and oversaw weekly research meetings
- Invited guest speakers to present at group meetings

BYU Marching Band and Basketball Pep Band Jul 2014 – Mar 2015
1st Trombone Jul 2010 – Dec 2011
Rocky Mountain Invitational Organizing Committee Member Provo, UT

- Performed at an elite level in front of tens of thousands of people at televised sporting events
- Co-Organized one of the largest marching band competition in Utah and surrounding states

Great Basin Supply Mar 2014 – Oct 2014

Janitor Sep 2010 – Mar 2012

- Nightly cleaning of two branches of Central Bank Provo, UT
- Interior painting
- Installation of advertisements for real estate

Volunteer Representative for the Church of Jesus Christ of Latter-day Saints Mar 2012 – Mar 2014

Missionary Janesville, Milwaukee, Madison, and Green Bay, WI

- Interpreted for religious services English-Spanish and Spanish-English
- Taught English classes for Hispanic minority groups
- Volunteered at hospitals and food pantries
- Lead groups of 6-12 volunteers in weekly training meetings on leadership, goal setting, and teaching

BYU School of Fine Arts Jan 2011 – Dec 2011

Electrician's Assistant Provo, UT

- Set up and tested theatrical stage lighting equipment in the Harris Fine Arts Center and Marriott Center
- Operated theatrical lighting during various performance events
- Mechanical lift certified

BYU Student Association Chess Club Jan 2011 – Dec 2011

President Provo, UT

- Planned and participated in intercollegiate chess tournaments
- Planned and oversaw weekly activates
- Organized and participated in community outreach