Nathan M. Smith

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Department of Physics and Astronomy
Northern Arizona University
Flagstaff, AZ

EDUCATION

Master of Science, Northern Arizona University, Flagstaff, Arizona — August 2018

- Applied Physics, Planetary Science Emphasis
- Coursework including:
  - Data and Error Analysis
  - Observational Astronomy Techniques
  - Physics of the Solar System
  - Astroinformatics
  - Python for Scientists

Bachelor of Arts, Augustana College, Rock Island, Illinois — May 2014

- Major: Physics
- Minors: Mathematics, Geology
- Coursework including:
  - Structural Geology
  - Geomorphology
  - Mineralogy
  - Igneous Petrology
  - Thermodynamics
  - Java Programming

RESEARCH

Research Specialist, Senior — 2018 - Present

Dr. Christopher Edwards, Northern Arizona University, Flagstaff, Arizona

- Developing data processing pipeline to create higher-level data products from spectra of Mars, to be collected by the Emirates Mars InfraRed Spectrometer (EMIRS) instrument on the UAE Emirates Mars Mission
- Assembling and maintaining new computing hardware resources to perform processing for this pipeline

Graduate Research Assistant — 2015 - 2018

Dr. Christopher Edwards, Northern Arizona University, Flagstaff, Arizona

- Associated Planetary Data System archival data from the Thermal Emission Spectrometer (TES) instrument onboard NASA's Mars Global Surveyor (MGS) spacecraft, collected during MGS's aerobraking period, with their locations on Phobos and prepared these newly reformatted data for distribution
- Developed a thermophysical model of Phobos, Mars' larger moon, in C, incorporating Mars-shine, eclipsing, and surface roughness
- Scripted iterations of this model using a processing pipeline developed in Python, varying surface properties and illumination conditions
- Leveraged the Mars Climate Database to accurately describe the influence of Mars on Phobos
- Placed spatially-resolved constraints on the thermal inertia of Phobos' surface by comparing TES observations to model output
- Developed software tools using Python to use TES spectra to map the variation of thermal inertia across Phobos' surface
- Produced a catalog of Phobos surface temperature maps for different times of day and season, and prepared these higher-level data products for distribution
- Compared these results with those drawn from observations made by all other Mars-orbiting spacecraft
- Presented results at the NASA Small Bodies Assessment Group January 2018 meeting and numerous scientific conferences

Instrument Development Team-member — 2016 - Present

Drs. David Trilling, Christopher Edwards, Michael Mommert, Northern Arizona University, Flagstaff, Arizona

- As a 10-person team, developed, constructed, and commissioned the Thermal Infrared Planetary Science Imager (TIPSI), a novel infrared camera system for the 0.51m NAU campus telescope
- Lead commissioning observations to estimate instrument sensitivity

- Selected targets for observation using JPL's Horizons Database
- Lead observations of the Moon during lunar eclipse to determine surface thermal properties
- Contributed to design of mounting hardware and software user interface
- Developed image processing pipeline to remove instrument noise and determine target temperature and relative thermal inertia
- Mentored undergraduate collaborators

Undergraduate Researcher 2012
Dr. Nathan Frank, MoNA Collaboration, Augustana College, Rock Island, Illinois

- Programmed and carried out a simulation, modelling an ongoing nuclear physics experiment at Michigan State University
- Utilized an object-oriented C environment, ROOT, to analyze large datasets
- Recorded ion beam characteristics onsite at MSU during data acquisition

TEACHING

Graduate Teaching Assistant 2015 - Present
Department of Physics and Astronomy, Northern Arizona University, Flagstaff, Arizona
Physics 112 Lab – Electrostatics, circuits, magnetism, lens and mirror optics
Astronomy 181: Introduction to Observational Astronomy – Fundamental astronomy concepts, scientific inquiry, quantitative reasoning, naked-eye and telescopic observing, software tools

Substitute Teacher 2014 - 2015
Riverside Brookfield High School, Riverside, Illinois
All subject areas

Interpreter/Facilitator 2014
Public Programs, Adler Planetarium, Chicago, Illinois
Operated and guided tours of the historic Atwood Sphere, a 1913 mechanical globe planetarium
Led demonstrations of science principles, including rocket propulsion, the EM spectrum, and vacuums
Guided exploration for youth visitors through hands-on experimentation

Lab Proctor 2012 - 2014
Department of Physics and Astronomy, Augustana College, Rock Island, Illinois
Physics 101 Lab – Mechanics, harmonic oscillation
Physics 102 Lab – Thermodynamics, electrostatics, circuits, magnetism
Physics 103 Lab – Lens and mirror optics, diffraction, nuclear physics

PUBLICATIONS

N. M. Smith, M. Mommert, C. S. Edwards, D.E. Trilling, and T. D. Glotch (2018), "Mapping the Thermal Inertia of Phobos using MGS-TES Observations and Thermophysical Modeling", *in prep.*

N. M. Smith (2018), "Mapping the Thermal Inertia of Phobos using Thermal Infrared Spectra and Thermophysical Modeling", MS Thesis, Northern Arizona University Department of Physics and Astronomy.

D. E. Trilling, T. Robinson, A. Roegge, C. O. Chandler, **N. M. Smith**, M. Loeffler, C. Trujillo, S. Navarro-Meza, L. Glaspie (2017), "Implications for Planetary System Formation from Interstellar Object 1I/2017 U1 ('Oumuamua)", ApJ Letters, 850, L38. https://doi.org/10.3847/2041-8213/aa9989

J. K. Smith, T. Baumann, D. Bazin, J. Brown, S. Casarotto, P. A. DeYoung, N. Frank, J. Hinnefeld, M. Hoffman, M. D. Jones, Z. Kohley, B. Luther, B. Marks, **N. M. Smith**, J. Snyder, A. Spyrou, S. L. Stephenson, M. Thoennessen, N. Viscariello, and S. J. Williams (2014), "Low-lying neutron unbound states in Be12", Phys. Rev. C, 90, 024309.

PRESENTATIONS

N. M. Smith, C.S. Edwards, M. Mommert, D.E. Trilling, and T. Glotch (2018), "Mapping the Thermal Inertia of Phobos using Thermal Infrared Spectra and Thermophysical Modeling", *Master's Thesis Defense*, Northern Arizona University Department of Physics and Astronomy, June 28, 2018. Flagstaff, Arizona.

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N. M. Smith, C.S. Edwards, M. Mommert, D.E. Trilling, and T. Glotch (2018), "Mapping the Thermal Inertia of Phobos using MGS-TES Observations and Thermophysical Modeling", *poster*, Lunar and Planetary Institute, 49th Lunar and Planetary Science Conference, Abstract 2809. The Woodlands, Texas.

N. M. Smith (2018), "A Thermophysical Model of Phobos", *15-minute talk*, NASA Small Bodies Assessment Group, SBAG-18, Moffett Field, California.

N. M. Smith, C.S. Edwards, M. Mommert, D.E. Trilling, and T. Glotch (2016), "Thermal Infrared Observations and Thermophysical Modeling of Phobos", *poster,* American Astronomical Society, Division for Planetary Science Conference #48, id.428.04. Pasadena, California.

N. M. Smith (2016), "Thermal Infrared Observations and Thermophysical Modeling of Phobos", *5-minute talk*, Flagstaff Astronomy Symposium, September 2016, Flagstaff, Arizona.

N. M. Smith, C.S. Edwards, M. Mommert, D.E. Trilling, and T. Glotch (2016), "Thermal Infrared Observations and Thermophysical Modeling of Phobos", *poster,* Solar System Exploration Research Virtual Institute, NASA Exploration Science Forum 2016, NESF2016-128. Moffett Field, California.

N. M. Smith, C.S. Edwards, M. Mommert, D.E. Trilling, and T. Glotch (2016), "Thermal Infrared Observations and Thermophysical Modeling of Phobos", *poster,* Third International Conference on the Exploration of Phobos and Deimos, PhD2016-031. Moffett Field, California.

N. M. Smith (2016), "Thermophysical Modelling of Phobos", *5-minute talk*, Steward Observatory Internal Symposium, March 2016, Tucson, Arizona.

N. M. Smith (2012), "Active Target Simulation", *poster,* Poster Session, 2012 Quadrennial Physics Congress. Orlando, Florida.

AWARDS

Early Career Travel Support, SBAG-18 Meeting, NASA Small Bodies Assessment Group
Nominee, 2017 Award for Outstanding Graduate Teaching Assistant, Northern Arizona University Graduate College

MEMBERSHIPS

American Geophysical Union, Student Member
American Astronomical Society, Junior Member
Geological Society of America, Student Member
Society of Physics Students
Sigma Xi

SERVICE

Graduate Student Representative, Department of Physics and Astronomy, Northern Arizona University 2016 - 2018

Geocorps America Participant, Geological Society of America Summer 2015
Night sky programming development, Joshua Tree National Park, CA

President, Augustana College chapter, Society of Physics Students 2013 - 2014
Organized Zone 9 regional meeting 2013
Vice President 2012 - 2013

PROFESSIONAL REFERENCES

Christopher Scott Edwards, Assistant Professor, Dept. of Physics and Astronomy, Northern Arizona University, Flagstaff, Arizona
Relationship: Academic Advisor
Tel: 928.523.7234
E-mail: Christopher.Edwards@nau.edu

Michael Mommert, Assistant Astronomer, Lowell Observatory, Flagstaff, Arizona

Nathan Smith nathansmith.planetary@gmail.com

Relationship: Collaborator
Tel: 928.223.3261
E-mail: Michael.Mommert@lowell.edu

David Trilling, Associate Professor, Dept. of Physics and Astronomy, Northern Arizona University, Flagstaff, Arizona

Relationship: Graduate Program Coordinator
Tel: 928.523.5505
E-mail: David.Trilling@nau.edu