# ROY T. SMART

+1 (801)-906-1539 ⋄ roy.smart@montana.edu
Department of Physics, Montana State University
Barnard Hall, Room 264

## INTERESTS

- Solar imaging and spectroscopy
- Solar transition region explosive events
- Optics modeling and tolerancing
- Machine learning
- Software engineering
- High-performance numerical simulation

## EDUCATION

**Ph.D. Candidate in Physics** Aug 2015 - Present
Department of Physics, Montana State University

**Bachelor of Science in Physics** Aug 2011 - May 2015
Department of Physics, Montana State University

## WORK EXPERIENCE

**Department of Physics, Montana State University** Jan 2016 - Present
*Graduate Research Assistant for Professor Charles Kankelborg* *Bozeman, MT*

- ESIS data analysis. Developed a convolutional neural network algorithm to process observations from the EUV Snapshot Imaging Spectrograph (ESIS), a NASA sounding rocket mission designed to measure the velocity of plasma in the solar transition region.
- ESIS Python library. Optical parameters and raytrace model of the ESIS instrument.
- Optical testing and assembly of ESIS. Checked quality of optics using phase-shifting interferometry. Developed procedures to align and focus the ESIS optics using a Zemax model of the instrument.
- ESIS launch campaign at White Sands Missile Range, NM. Operated the ESIS instrument during integration, testing, and flight operations.
- Optical design of the Full-Sun Ultraviolet Rocket Spectrometer (FURST), a NASA sounding rocket mission designed to measure the vacuum ultraviolet spectrum of the Sun as a star. Used Zemax to validate and characterize an optical system proposed by Charles Kankelborg.

**Department of Physics, Montana State University** Aug 2015 - Dec 2015
*Graduate Teaching Assistant for Professor Nicholas Childs* *Bozeman, MT*

- Assisted with conducting the labs, test proctoring, and grading.

**Department of Physics, Montana State University** Sep 2012 - Aug 2015
*Undergraduate Research Assistant for Professor Charles Kankelborg* *Bozeman, MT*

- MOSES II flight software development. Wrote and tested software to control the cameras on the Multi-Order Solar EUV Spectrograph (MOSES), a predecessor to ESIS which also measures the velocity of plasma in the solar transition region.
- MOSES data analysis. Trained a convolutional neural network to process observations from the MOSES instrument.
- MOSES II launch campaign. Operated the MOSES instrument during integration, testing, and flight operations at White Sands Missile Range, NM.

## TECHNOLOGY SKILLS

| | |
|---|---|
| **Design Software** | Zemax |
| **Programming Languages** | Python, C/C++, IDL, CUDA C/C++, Java, Mathematica |
| **Frameworks and libraries** | Numpy, Scipy, Astropy, Pandas, Keras, Sphinx |
| **Office Accessories** | MS Word, MS Power-point, MS Excel etc. |

## AWARDS

**NASA Earth and Space Science Fellowship** Sep 2017 - Sep 2020

## PUBLICATIONS AND PRESENTATIONS

- J. D. Parker, **Smart, R.**, N. C. Goldsworth, C. C. Kankelborg, A. R. Winebarger, K. Kobayashi, and L. Rachmeler. "Doppler Measurements of Transition Region Transient Events at 630 Angstroms from the ESIS Sounding Rocket". In: *AGU Fall Meeting Abstracts*. Vol. 2020. Dec. 2020, SH048-0004, SH048–0004
- **Smart, R.**, C. C. Kankelborg, and J. D. Parker. "Convolutional Neural Networks for Tomographic Imaging Spectroscopy of the Solar Atmosphere". In: *AGU Fall Meeting Abstracts*. Vol. 2020. Dec. 2020, SH048-0003, SH048–0003
- C. C. Kankelborg, J. D. Parker, **Smart, R.**, A. R. Winebarger, K. Kobayashi, L. Rachmeler, and H. Courrier. "First Flight of the EUV Snapshot Imaging Spectrograph". In: *AGU Fall Meeting Abstracts*. Vol. 2019. Dec. 2019, SH33A-05, SH33A–05
- **Smart, R.**, C. C. Kankelborg, J. D. Parker, H. Courrier, A. R. Winebarger, K. Kobayashi, and L. Rachmeler. "A Neural Network-based Data Analysis Technique for the EUV Snapshot Imaging Spectrograph". In: *AGU Fall Meeting Abstracts*. Vol. 2019. Dec. 2019, SH31C-3321, SH31C–3321
- **Smart, R.** and C. C. Kankelborg. "Machine Learning Techniques for Computed Tomography Imaging Spectroscopy of the Solar Atmosphere". In: *AGU Fall Meeting Abstracts*. Vol. 2018. Dec. 2018, SH23A-05, SH23A–05
- Micah A. Johnson, Charles C. Kankelborg, Rubin Meuchel, and **Roy Smart**. "Confocal microscopy for high-precision non-contact optical measurements". In: *Optical System Alignment, Tolerancing, and Verification XII*. vol. 10747. Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series. Sept. 2018, 107470A, 107470A. DOI: 10.1117/12.2319597
- Charles Kankelborg, Judge Philip, Amy R. Winebarger, Ken Kobayashi, and **Roy Smart**. "VUV Spectroscopy of the Sun as a Star". In: *AAS/Solar Physics Division Abstracts #48*. Vol. 48. AAS/Solar Physics Division Meeting. Aug. 2017, 110.01, p. 110.01
- **Roy Smart**, Charles C. Kankelborg, Nick Bonham, and Hans Courrier. "Measuring Plasma Flows in Transition Region Loops Using the MOSES Instrument". In: *AAS/Solar Physics Division Abstracts #48*. Vol. 48. AAS/Solar Physics Division Meeting. Aug. 2017, 106.10, p. 106.10
- **Roy Smart**, Hans Courrier, and Charles Kankelborg. "Preliminary Results of the MOSES II 2015 Flight". In: *AAS/Solar Physics Division Abstracts #47*. Vol. 47. AAS/Solar Physics Division Meeting. May 2016, 309.01, p. 309.01

## REFERENCES

*Dr. Charles Kankelborg*
*Professor*
*Department of Physics, Montana State University,*
*Bozeman, MT*
*Tel: 406-994-7853*
*email: kankel@montana.edu*
*Relation: Supervisor & Course Teacher*

*Dr. Jacob Parker*
*Research Scientist*
*NASA Goddard Space Flight Center,*
*Greenbelt, MD*
*Tel: 208-520-2807 (Cell)*
*email: jacob.d.parker@nasa.gov*
*Relation: Colleague*