Dr. James M DerKacy

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Education

Aug 2015 – Present | **University of Oklahoma, Norman**
PhD (Physics), 2022
MS (Physics), 2018

Sept 2011 – June 2015 | **North Central College**
BA (Physics, Political Science), 2015
Cum Laude

Research Topics & Interests

Supernovae, Radiative Transfer, Spectroscopy, Ultraviolet, Theory, Observational Astronomy

Research Experience

Sept 2022 – Present | **Virginia Polytechnic Institute and State University**
Postdoctoral Associate
Advisor: Dr. Chris Ashall
My research covers investigates multiple aspects of supernova physics. I analyze the data of multiple JWST programs through the MidInfared SuperNovA Collaboration (MIRSNAC). As a member of the POISE (Precision Observations of Infant Supernova Explosions) collaboration, I also focus on both rapid and long-term follow-up of infant supernovae of all types. I serve as an advisor and mentor to Virginia Tech undergraduate and graduate students.

Aug 2015 – July 2022 | **University of Oklahoma**
Graduate Research Assistant
Advisor: Dr. Eddie Baron
Thesis: Understanding Type Ia Supernova Diversity with `PHOENIX`
My work covers both theoretical and observational aspects of supernova spectra. I utilize the `PHOENIX` radiative transfer code to generate synthetic NLTE spectra to better explain the diversity of Type Ia SNe. My work covers the UVOIR, with focuses on ultraviolet spectra and the exploration of physical differences seen as variations of optical and UV spectra characterized by Branch subgroups. I also use part of OU's time allotment at Apache Point Observatory as part of POISE for optical spectra of supernovae and other transients from the first days after explosion through to the nebular phase. These early and late phase observations allow us to explore outstanding questions about the progenitors and explosion mechanics of supernovae.

June 2014 - Dec 2014

High Energy Physics, Argonne National Lab
SULI Intern
Advisor: Dr. Steve Kuhlmann
Assisted in the development of silicon photonics for use as atmospheric OH filters for infrared cameras. Contributions included computer simulations of ring resonator systems and the testing of optical fiber coupling techniques with prototype ring resonator units. Supported the Dark Energy Survey (DES) Supernova group at Argonne National Lab, including analysis of supernova light curves for cosmology research and the identification of spectroscopic follow-up targets as part of OzDES.

Refereed Publications

Papers in Progress

- **DerKacy, J.**, et al., *JWST MIR Observations of SN 2021aefx*
- **DerKacy, J.**, et al., *PHOENIX Modeling of Broad Line Type Ia Supernovae*

2022

1. **DerKacy, J. M.**, Paugh, S., Baron, E., et al., *SN 2021fxy: Mid-Ultraviolet Flux Suppression is a Common Feature of Type Ia Supernovae*, MNRAS, submitted.
2. Yarbrough, Z., Baron, E., **DerKacy, J. M.**, and Hoeflich, P., 2022, *Direct Analysis of the Broad-Line SN 2019ein: Connection with the Core-Normal SN 2011fe*, MNRAS, in review.
3. Ashall, C., Lu, J., Shappee, B.J, ... **DerKacy, J.**, et al., 2022, *A Speed Bump: SN 2021aefx Shows that Doppler Shift Alone can Explain Early-Excess Blue Flux in Some Type Ia Supernovae*, ApJL, 932, L2 doi:10.3847/2041-8213/ac7235
4. Zhang, X., Wang, X., Sai, H., ... **DerKacy, James M.**, et al., 2022, *SN 2019va: A Type IIP Supernova with an Unusually Large Contribution of Nickel-56 Decay to the Plateau-Phase Light Curve*, MNRAS, 513, 4556 doi:10.1093/mnras/stac1166
5. Zhang, X., Wang, X., Sai, H., ... **DerKacy, J. M.**, et al., 2022, *SN 2018hfm : A Low-Energy Type II Supernova with Prominent Signatures of Circumstellar Interaction and Dust Formation*, MNRAS, 509, 2013. doi:10.1093/mnras/stab3007

2021

6. Zeng, X., Wang, X. F., Esamdin, A., ... **DerKacy, James M.**, et al. 2021, *SN 2017hpa: A Nearby Carbon-rich Type Ia Supernova with a Large Velocity Gradient* ApJ, 909, 176, doi:10.3847/1538-4357/abdeb9

2020

7. Zhang, J., Wang, X., Vinko, J., ... **DerKacy, James M.**, et al. 2020, *SN 2018zd: An Unusual Stellar Explosion as Part of the Diverse Type II Supernova Landscape*, MNRAS, 498, 84Z, doi:10.1093/mnras/staa2273
8. Lin, W. L., Wang, X. F., Li, W. X., ... **DerKacy, J. M.**, et al. 2020, *SN 2018hti: A Nearby Superluminous Supernova Discovered in a Metal-poor Galaxy*, MNRAS, 497, 318L, doi:10.1093/mnras/staa1918
9. **DerKacy, J. M.**, Baron, E., Branch, D., et al. 2020, *Ultraviolet Line Identifications and Spectral Formation Near Max Light in Type Ia Supernova 2011fe*, ApJ, 901, 86, doi:10.3847/1538-4357/abae67
10. Jacobson-Galán, W. V., Margutti, R., Kilpatrick, C. D., ... **DerKacy, James M.**, et al. 2020, *SN 2019ehk: A Double-peaked Ca-rich Transient with Luminous X-Ray Emission and Shock-ionized Spectral Features*, ApJ, 898, 166, doi:10.3847/1538-4357/ab9e66
11. Bostroem, K. A., Valenti, S., Sand, D. J., ... **DerKacy, J. M.**, et al. 2020, *Discovery and Rapid Follow-up Observations of the Unusual Type II SN 2018ivc in NGC 1068*, ApJ, 895, 31, doi:10.3847/1538-4357/ab8945.

2019

12. Xiang, D., Wang, X., Mo, J. ... **DerKacy, James M.**, et al. 2019, *Observations of SN 2017ein Reveal Shock Breakout Emission and a Massive Progenitor Star for a Type Ic Supernova*, ApJ, 871, 176, doi:10.3847/1538-4357/aaf8bo
13. Dimitriadis, G., Foley, R. J., Rest, A., ... **DerKacy, J. M.** et al. 2019, *K2 Observations of SN 2018oh Reveal a Two-component Rising Light Curve for a Type Ia Supernova*, ApJ, 870, L1, doi:10.3847/2041-8213/aaedbo
14. Shappee, B. J., Holoien, T. W.-S., Drout, M. R. ... **DerKacy, J. M.**, et al. 2019, *Seeing Double: ASASSN-18bt Exhibits a Two-component Rise in the Early-time K2 Light Curve* , ApJ, 870, 13, doi:10.3847/1538-4357/aaec79
15. Li, W., Wang, X., Vinkó, J., ... **DerKacy, J. M.**, et al. 2019, *Photometric and Spectroscopic Properties of Type Ia Supernova 2018oh with Early Excess Emission from the Kepler 2 Observations*, ApJ, 870, 12, doi:10.3847/1538-4357/aaec74

Talks & Presentations

2022

- **(Invited)** *Ultraviolet Spectra in Type Ia Supernovae*, Virginia Tech Astronomical Sciences Seminar, November 2022
- *SN 2021fxy: A "Cousin" of SN 2017erp with a Strong Ultraviolet Resemblance*, 240th AAS Meeting, June 2022
- *SN 2021fxy: A "Cousin" of SN 2017erp with a Strong Ultraviolet Resemblance*, Cooks Branch Supernova Workshop, March 2022

2021

- *SN 2021fxy: An Unreddened Cousin of SN 2017erp?* (Poster), SuperVirtual Conference, November 2021
- **(Invited)** *Ultraviolet Line Identification and Spectral Formation Near Max-light in Type Ia Supernova 2011fe*, University of Kansas Astronomy and Space Physics Seminar, October 2021
- *SN 2021fxy: A "Shallow-Silicon" Type Ia Supernova Masquerading As A "Core-Normal"*, Apache Point Observatory Science Symposium, July 2021
- *Probing Spectral Formation of Type Ia Supernovae using* `PHOENIX`, 237th AAS Meeting, January 2021

2020

- *Ultraviolet Line Identification and Spectral Formation Near Max-light in Type Ia Supernova 2011fe*, CSP Collaboration Workshop, September 2020
- *Ultraviolet Line Identifications in Near Max Light Spectra of Type Ia Supernova 2011fe* (Poster), 235th AAS Meeting, January 2020

2018

- *Models of Interacting Supernovae: Understanding the Physics and Probing the Circumstellar Environment* (Poster), MidAmerican Regional Astrophysics Conference, April 2018

2015

- *OH Line Suppression Research for Future Near-Infrared Camera Development* (Poster), Rall Symposium for Undergraduate Research, North Central College, May 2015

2014

- *OH Line Suppression Research for Future Near-Infrared Camera Development*, 24th Annual Argonne Undergraduate Research Symposium, Argonne National Lab, October 2014

Supervised Students & Outcomes

Graduate Students

- Cassie Stevens, Virginia Tech, Sept. 2022 - Present

Undergraduates

- Zach Yarbrough, University of Oklahoma, Feb 2021 - Present; Graduate Student at LSU
- Sara Paugh, University of Oklahoma, May 2021 - Present; Graduated

Teaching Experience

University of Oklahoma

Spring 2021	ASTR 5453 - Extragalactic Astronomy & Cosmology, Grader ASTR 5900 - Numerical Methods, Grader
Fall 2020	ASTR 3103 - Stars, Grader
Spring 2017	PHYS 2524 - Gen. Physics for Life Sciences, Graduate TA
Fall 2016	ASTR 1514 - General Astronomy, Laboratory Instructor
Summer 2016	PHYS 2514 - Gen. Physics for Engineers, Graduate TA
Spring 2016	ASTR 1514 - General Astronomy, Laboratory Instructor
Fall 2015	ASTR 1514 - General Astronomy, Laboratory Instructor

North Central College

Winter 2013	PHY 142 - Physics II, Laboratory TA
Fall 2012	PHY 141 - Physics I, Laboratory TA

Community Outreach & Department Service

Virginia Tech Astro Journal Club
Role: Organizer, Oct. 2022 - Present
Organize weekly journal club discussions for astronomers of recent, high impact, and noteworthy works cultivated from new publications and arXiv postings.

Summer REU Mentor
Summer 2021
Co-advised undergraduate REU student Sara Paugh on her work with SN 2021fxy. Responsibilities included assisting Sara in learning several analysis codes, such as `SYNOW` and `MISFITS`.

Graduate Physics Student Interdependence (GPSI)
Roles: President, 2019 - 2020, Vice President, 2017 - 2019
GPSI is the graduate student advocacy group within the Physics & Astronomy department at OU. GPSI's goals are to promote the success of graduate physics and astronomy students at OU by further developing the sense of community within the department via sponsored events and activities, and by improving communication between the graduate students and the faculty. Responsibilities of the President and Vice-President include representing graduate students during faculty meetings, collecting graduate student feedback for faculty searches and tenure committees, and helping coordinate prospective graduate student visits and welcome events for incoming graduate students (eg. Welcome Mixers, Departmental TA Training).

Lunar Sooners
Roles: Engineer, 2016 - 2017, Member 2015 - 2022
Lunar Sooners is a graduate student-led outreach arm of the Astronomy groups within the Physics & Astronomy Department. Lunar Sooners mission is to share the joy of astronomy with the greater Oklahoma community,

with a particular focus on outreach to under-represented communities. Members host 2-3 events per semester including the weekly public star parties held at the university observatory, and special events for outside groups. Events often consist of star parties, panel discussions, interactive demonstrations, and our portable planetarium nicknamed the Soonertarium. A selection of outside groups for whom I've hosted events include branches of both the Metropolitan and Pioneer Library Systems in the OKC area, the Sam Noble Oklahoma Museum of Natural History, and numerous local scouting groups. As the Lunar Sooners Engineer, my responsibilities included maintenance and upkeep of all department and Lunar Sooners telescopes and equipment and the university observatory.

References

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Dr. Peter J. Brown
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Texas A&M University
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