Steven Mathis Silverberg

Personal Data

Position:	Astrophysicist (Post-doctoral Fellow)
Institution:	Smithsonian Astrophyical Observatory
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Research Interests

High-energy observations of young low-mass stars: I use X-ray data from *XMM-Newton* and *Chandra* to characterize the behavior of young stars. This includes using X-rays to identify diskless members of star-forming regions, and using X-ray spectra to characterize the composition of the coronae, outflows, and accretion materials of classical T Tauri stars. These high-energy observations can give us the most detailed information about conditions *at the stellar surface* while dust and gas obscure the star at longer wavelengths.

Citizen Science: For the past ten years, I have worked on Disk Detective, a project to identify new circumstellar disk candidates from the AllWISE catalog via citizen science. This project has identified hundreds of new circumstellar disk candidates, prime targets for observation with JWST, and engaged thousands of people worldwide in scientific discovery. I am interested in extending this practice as new surveys (e.g. SPHEREx, Rubin/LSST) come online.

"Peter Pan" Disks: As part of Disk Detective, I led identification of a set of disk candidates around late-type stars with infrared excess typical of a protoplanetary disk at ages >9 times the characteristic timescale for protoplanetary disk dissipation around solar-type stars. I use optical and near-IR photometry and spectroscopy to characterize the hosts of these "Peter Pan" disks (primordial disks that seem to never grow up), as a means of understanding how they formed, and their implications on exoplanet formation around M dwarfs.

Education

Ph.D., Physics, University of Oklahoma — Spring 2019
Advisors: John P. Wisniewski, Marc J. Kuchner

M.S., Physics, University of Oklahoma — Spring 2016

B.S., Astrophysics, Rice University — Spring 2013

Employment History

Astrophysicist (Postdoctoral Fellow), SAO — August 2022-Current
Mentor: Scott Wolk

Post-doctoral Associate, MIT Kavli Institute — August 2019-August 2022
Mentors: H. Moritz Günther, David Principe

Graduate Research Collaborator, NASA GSFC — August 2015 - July 2019
Advisor: Marc J. Kuchner — June 2014 - July 2014

Graduate Research Assistant, University of Oklahoma — June 2014 - July 2019
Advisor: John P. Wisniewski

Grants and Awards

PI, 2021B, Magellan/MIKE – 0.5 nights awarded, 2021

Science PI, NASA Citizen Science Seed Funding Program grant "Disk Detective v2.0: Identifying Unusual Circumstellar Disks Via Citizen Science", 2020, $37k

PI, 2020A, Magellan/MIKE – 2 nights awarded, 2020 (unobserved due to the COVID-19 pandemic)

Co-I, Chandra Cycle 21, 162 ks, 2019

PI, GS-2018B-FT-106, Gemini-S/GMOS-S – 1.4 hours awarded, 2018

PI, 2018A-088, NASA IRTF/SpeX – 1 night + 4 hours, 2018

PI, 2018A-0292, CTIO Blanco/ARCoIRIS, 1.5 nights, 2018

PI, 2017B-0229, CTIO Blanco/ARCoIRIS, 3 $\times$ half-nights, 2017

PI, 2017Q4-DD03, Apache Point Observatory ARC 3.5m/DIS, 3 $\times$ half-nights, 2017

PI, 2017Q3-OU01, Apache Point Observatory ARC 3.5m/DIS, 2 $\times$ half-nights + 2 hours, 2017

Robert H. Goddard Award for Exceptional Achievement in Outreach by a Team. Presented to the Disk Detective team, May 2017.

PI, 2017A-0259 CTIO 0.9m (9 nights), Blanco/COSMOS (1/2 night), 2017

Co-I, SOFIA Cycle 5, Do If Time, 3 flights, 2017

Co-I, Director's Discretionary Fund Grant, Space Telescope Science Institute, $101k

Co-I, NASA XRP Grant "The Disk Detective Follow-up Program," 2016, $500k

Additional Observing Experience

2010Q2	0.9 meter Telescope, McDonald Observatory – 3 nights
2014Q4	ARC 3.5m Telescope, Apache Point Observatory (PI) – 1 half-night
2015Q2	APO/ARC 3.5m – 3 nights. Observational Astrophysics course
2015B	du Pont Telescope (2.5m), Las Campanas Observatory (Co-I, observer) – 3 nights

Data Analysis Experience: X-ray imaging, X-ray spectroscopy, optical imaging, near-infrared imaging, optical spectroscopy, near-infrared spectroscopy

Software Experience: Python (astropy), CIAO, Sherpa, XMMSAS, IDL, C, IRAF, Java, MATLAB

Selected Professional Talks

NASA CitSciCon, "PlanetPalooza" panel discussion, May 2021

"Building the NASA Citizen Science Community" conference, Tucson, AZ, June 2019

Space Telescope Science Institute, Exoplanet Seminar, November 2018

Massachusetts Institute of Technology, Exoplanet Tea, October 2018

Carnegie Institution for Science, DTM Seminar, October 2018

Goddard Space Flight Center, Exoplanet Club Seminar, August 2018

Harvard-Smithsonian Center for Astrophysics, Seminar, July 2018

American Museum of Natural History, Seminar, July 2018

Goddard Space Flight Center, Star Formation Seminar, May 2018

Gemini Observatory + CTIO, Astronomy Colloquium, November 2017

University of Colorado-Boulder, JILA Astrophysics Seminar, July 2017

Refereed Publications

1. **Silverberg, S.M.**, Günther, H.M., Pradhan, P., Principe, D.A., Schneider, P.C., Wolk, S.J. 2023, "Stable Coronal X-Ray Emission Over Twenty Years of XZ Tau," AJ, 166, 148
2. Evans, N.R., Ferrari, M.G., Kuraszkiewicz, J., **Silverberg, S.**, Nichols, J., Torres, G., Fischbach, M. 2023, "The Mass-Temperature Relation for B and Early A Stars Based on International Ultraviolet Explorer Spectra of Detached Eclipsing Binaries," AJ, 166, 109
3. Laos, S., Wisniewski, J.P., Kuchner, M.J., **Silverberg, S.M.**, Günther, H.M., Principe, D.A., Bonine, B., Kounkel, M., Disk Detective Collaboration. 2022, "Chandra Observations of Six Peter Pan Disks: Diversity of X-Ray-driven Internal Photoevaporation Rates Does Not Explain Their Rare Longevity," ApJ, 935, 111
4. Higashio, S., Kuchner, M.J., **Silverberg, S.M.**, Brandt, M.A., Grubb, T.C., Gagné, J., Debes, J.H., Schlieder, J., Wisniewski, J.P., Slocum, S., Bans, A.S., Bhattacharjee, S., Biggs, J.R., Bosch, M.K.D., Cernohaus, T., Doll, K., Durantini Luca, H.A., Enachioaie, A., Griffith, P., Hamilton, J., Holden, J., Hyogo, M., Jung, D., Lau, L., Piniero, F., Piipuu, A., Stiller, L., Disk Detective Collaboration. 2022, "Disks in Nearby Young Stellar Associations Found Via Virtual Reality," ApJ, 933, 13
5. **Silverberg, S.M.**, Günther, H.M., Kim, J.S., Principe, D.A., Wolk, S.J. 2021, "What's Behind the Elephant's Trunk? Identifying Young Stellar Objects on the Outskirts of IC 1396," AJ, 162, 279
6. Schutte, M.C., Lawson, K.D., Wisniewski, J.P., Kuchner, M.J., **Silverberg, S.M.**, Faherty, J.K., Bardalez Gagliuffi, D.C., Kiman, R., Gagné, J., Meisner, A., Schneider, A.C., Bans, A.S., Debes, J.H., Kovacevic, N., Bosch, M.K.D., Durantini Luca, H.A., Holden, J., Hyogo, M., Disk Detective Collaboration. 2020, "Discovery of a Nearby Young Brown Dwarf Disk," AJ, 160, 156
7. **Silverberg, S.M.**, Wisniewski, J.P., Kuchner, M.J., Lawson, K.D., Bans, A.S., Debes, J.H., Biggs, J.R., Bosch, M.K.D., Doll, K., Durantini Luca, H.A., Enachioaie, A., Hamilton, J., Holden, J., Hyogo, M., Disk Detective Collaboration. 2020, "Peter Pan Disks: Long-lived Accretion Disks Around Young M Stars," ApJ, 890, 106
8. **Silverberg, S.M.**, Kuchner, M.J., Wisniewski, J.P., Bans, A.S., Debes, J.H., Kenyon, S.J., Baranec, C., Riddle, R., Law, N., Teske, J.K., Burns-Kaurin, E., Bosch, M.K.D., Cernohous, T., Doll, K., Durantini Luca, H.A., Hyogo, M., Hamilton, J., Finnemann, J.J.S., Lau, L. 2018, "Follow-Up Imaging of Disk Candidates from the Disk Detective Citizen Science Project: New Discoveries and False Positives in WISE Circumstellar Disk Surveys," ApJ, 868, 43
9. Kuchner, M.J., Faherty, J.K., Schneider, A.C., Meisner, A.M., Filippazzo, J.C., Gagné, J., Trouille, L., **Silverberg, S.M.**, Castro, R., Fletcher, B., Mokaev, K., Stajic. T. 2017, "The First Brown Dwarf Discovered by the Backyard Worlds: Planet 9 Citizen Science Project," ApJL, 841, L19
10. **Silverberg, S.M.**, Kuchner, M.J., Wisniewski, J.P., Gagné, J., Bans, A.S., Bhattacharjee, S., Currie, T.R., Debes, J.H., Biggs, J.R., Bosch, M., Doll, K., Durantini-Luca, H.A., Enachioaie, A., Griffith, Sr., P., Hyogo, M., Piniero, F, Disk Detective Collaboration. 2016, "A New M Dwarf Debris Disk Candidate in a Young Moving Group Discovered with Disk Detective," ApJL, 830, L28
11. Kuchner, M.J., **Silverberg, S.M.**, Bans, A.S., Bhattacharjee, S., Kenyon, S.J., Debes, J.H., Currie, T., García, L., Jung, D., Lintott, C., McElwain, M., Padgett, D.L., Rebull, L.M., Wisniewski, J.P., Nesvold, E., Schawinski, K., Thaller, M.L., Grady, C.A., Biggs, J., Bosch, M., Cernohous, T., Durantini-Luca, H.A., Hyogo, M., Lau Wan Wah, L., Piipuu, A., Piniero, F. 2016, "Disk Detective: Discovery of New Circumstellar Disk Candidates through Citizen Science."

12. **Silverberg, S.M.**, Kowalski, A.F., Davenport, J.R.A., Wisniewski, J.P., Hawley, S.L, Hilton, E.J. 2016, "Kepler Flares. IV. A Comprehensive Analysis of the Activity of the dM4e Star GJ 1243," ApJ, 829, 129
13. Davenport, J.R.A., Hawley, S.L., Hebb, L., Wisniewski, J.P., Kowalski, A.F., Johnson, E.C., Malatesta, M., Peraza, J., Keil, M., **Silverberg, S.M.**, Jansen, T.C., Scheffler, M.S., Berdis, J.R., Larsen, D.M., Hilton, E.J. 2014, "Kepler Flares. II. The Temporal Morphology of White-light Flares on GJ 1243," ApJ, 797, 122

Conference Organization and Invited Participation

Scientific Organizing Committee, National Capital Area Disks meeting, September 2018

Invited participant, Crowdsourcing Expo, NASA HQ, May 2018

Invited participant, Citizen Science Expo, National Academies of Sciences, November 2017

Chair, Scientific Organizing Committee, National Capital Area Disks meeting, July 2016

Non-Refereed Abstracts

Silverberg, S.M., Guenther, H.M., Kim., J.S., Principe., D.A., Schneider, P.C., Wolk, S.J. 2024, AAS, 243, 215.03

Silverberg, S.M., Principe, D.A., Guenther, H.M., Kim, J.S., Pradhan, P., Schneider, P.C., Wolk, S.J. 2023, AAS, 241, 334.07

Silverberg, S.M., Kuchner, M.J., Disk Detective Collaboration. 2021, Cool Stars 20.5, id 281

Silverberg, S.M., Wisniewski, J.P., Kuchner, M.J., Disk Detective Collaboration. 2020, AAS, 235, 161.05

Silverberg, S.M., Kuchner, M.J., Wisniewski, J.P.. 2019, AAS, 233, 317.04

Silverberg, S.M., Kuchner, M.J., Wisniewski, J.P., Disk Detective Collaboration. 2018, Cool Stars XX, poster 283

Silverberg, S.M., Wisniewski, J.P., Kuchner, M.J., Disk Detective Collaboration. 2018, AAS, 231, 428.03

Silverberg, S.M., Kuchner, M.J., Wisniewski, J.P., Gagné, J., Bans, A.S., Bhattacharjee, S., Currie, T.M., Debes, J.H., Biggs, J.R., Bosch, M., Doll, K., Durantini Luca, H.A., Enachioaie, A., Griffith, P., Hyogo, M., Piniero, F., Disk Detective Collaboration. 2017, AAS, 229, 420.01

Press

Quoted in "Citizen scientists spot closest brown dwarf with disk; discovery may aid in understanding of planet formation", Boston Globe, June 2020

Quoted in "Citizen scientists spot closest young brown dwarf disk yet" press release, MIT News, June 2020

"Peter Pan Disks" paper featured in BBC Sky at Night magazine, March 2020

Quoted in "Found: Oldest Known Planet-forming Disk" press release, Carnegie Science, October 2016

Profiled in "OU Graduate Student, Team Discover Oldest Known Planet-forming Disk," OU Daily, October 2016

Quoted in "Oldest Planetary Disk Discovered With Help from Citizen Scientists," IFLScience, October 2016

Education and Public Outreach

Lower Merion School Night Guest lecturer on JWST, 2023

Jewish Community Day School of Rhode Island Guest presenter on astronomy as a career, 2021

NASA CitSciCon Presenter, "PlanetPalooza" discussion panel, 2021

Lunar Sooners Presented star parties and lectures as part of OU astronomy outreach group, 2013-2019

Soonertarium Organized and presented mobile planetarium shows for local schools, 2014-15

OKC Astronomy Club Guest lecturer on citizen science, 2014

OU Star Parties Frequent host of weekly viewings at OU on-campus observatory 2013-2019

Professional References

1. Dr. Scott J. Wolk
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2. Dr. H. Moritz Günther
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