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# Christopher C. Stark

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Code 667  
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## Research Interests

Debris disk modeling, detection, and observation; planet-disk interactions; extra-solar planets; dust dynamics; exozodiacal clouds; mission concept planning & science yield optimization

## Education

Ph.D. Physics	University of Maryland	2010
<i>Thesis: "Decoding Images of Debris Disks"</i>		
<i>Advisor: Dr. Marc J. Kuchner, NASA Goddard Space Flight Center</i>		
B.S. Physics with a Minor in Marketing	University of Northern Iowa	2004

## Current Appointment

NASA Postdoctoral Program Fellow	NASA GSFC	2013 – present
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*Modeling of collisional exozodiacal resonant ring structures to predict detectability and impact on future missions, exploring new methods of exozodi detection, modeling observed debris disk structures to search for signs of planets, exoplanet transit detection, future mission planning & science yield optimization.*

### Projects:

- PI, "Confirming the Recent Collisional Destruction of an Extra-Solar Pluto," ALMA Cycle 2, PI: Christopher Stark  
*Observations of the HD 181327 debris disk to determine the source of disk asymmetries consistent with a recent massive collision and confirm the scattering phase function measured from HST STIS observations*
- Co-I, "Decoding Debris System Substructures: Imprints of Planets/Planetesimals and Signatures of Extrinsic Influences on Material in Ring-Like Disks," HST Cycle 22 GO Proposal, PI: Glenn Schneider  
*Data analysis, image deprojection, and modeling of debris disks imaged through high-contrast techniques*
- Co-I, "SpiKeS: Spitzer Kepler Survey," Spitzer Space Telescope Cycle 10, PI: Michael Werner  
*Identification of IR debris disk excesses in the full Kepler field of view*
- Co-I, "SMACK: A New Tool for Modeling Debris Disks," HST Cycle 21 Theory Proposal, PI: Marc Kuchner

*Creation of a new publicly available dynamical modeling tool for debris disks*

- Co-I, “Small SpiKeS: Small Spitzer Kepler Survey,” Spitzer Space Telescope Cycle 9, PI: Michael Werner

*Identification of IR debris disk excesses in a subset of the Kepler field of view*

- Co-I, “EXCEDE: EXoplanetary Circumstellar Environments and Disk Explorer,” 2011 NASA Explorer Program, PI: Glenn Schneider

*Production of model disk images for mission simulation and scientific yield*

- Co-I, “Imaging Disk-Planet Interactions in the Beta Pictoris Disk,” HST Cycle 19 GO Proposal, PI: Daniel Apai

*Dynamical modeling of any variability observed in the Beta Pic disk*

- Co-I, “Probing for Exoplanets Hiding in Dusty Debris Disks: Inner (<10 AU) Disk Imaging, Characterization, and Exploration,” HST Cycle 18 GO Proposal, PI: Glenn Schneider

*Data analysis, image deprojection, and modeling of debris disks imaged through high-contrast techniques*

- Co-I, “Dynamical Models of the Zodiacal Cloud with Grain-Grain Collisions,” 2010 Planetary Geology and Geophysics Proposal, PI: Marc J. Kuchner

*Development of collisional modeling algorithms, modeling dynamical and collisional state of the zodiacal cloud and its dust sources, simultaneously fitting dynamical collisional models to multiple zodiacal cloud data sets*

## Professional Experience

**ATLAST Mission Concept Team Member** 2013 –

*Target selection, completeness and exposure time calculations, optimization of design to maximize science yield*

**Carnegie Postdoctoral Research Fellow** 2010 – 2013

*Debris disk detection and modeling, exoplanet detection*

**Kepler Science Team Collaborator** 2011 – 2012

*Searching for signs of structured exozodis in Kepler transit light curves*

**Keck Interferometer Nuller Key Science Co-Investigator** 2008 – 2010

*“The KIN Survey of Exozodiacal Dust around Nearby Stars,” PI: Dr. Eugene Serabyn*

*“Follow-up Observations of Circumstellar Disks with the KIN,” PI: Dr. Marc J. Kuchner*

**GSRP Research Fellow, NASA Goddard Space Flight Center** 2005 – 2009

*Numerical modeling of exozodiacal clouds and observed debris disks, Advisor: Dr. Marc J. Kuchner*

*Observations of debris disks with the Keck Interferometer Nuller, Advisor: Dr. Marc J. Kuchner*

Keck Interferometer Nuller Shared Risk Science Team <i>“Circumstellar Disk Detection with the Keck Nuller,” PI: Dr. Wesley A. Traub</i>	2006 – 2008
Research Assistant, NASA Goddard Space Flight Center <i>Analysis of GLAST anticoincidence detector test data, Advisor: Dr. Steven Ritz</i>	2005
MRSEC Research Fellow, University of Nebraska <i>Experimental AGFM studies of FePt:C thin films, Advisor: Dr. Ming Lang Yan</i>	2003
Research Assistant, University of Northern Iowa <i>Magnetic properties of mechanically milled alloys, Advisor: Dr. Paul M. Shand</i>	2002 – 2004

### Awards & Honors

Astrophysics Science Division Peer Award	NASA GSFC	2014
NASA Postdoctoral Program Fellowship	NASA GSFC	2013 – 2016
Carnegie Research Fellowship	Carnegie DTM	2010 – 2013
Astrophysics Science Division Peer Award	NASA GSFC	2009
NASA Graduate Student Research Fellowship	NASA GSFC	2006 – 2009
Hartman Travel Grant	AAS DPS	2009
Student Stipend Award	AAS DDA	2007
Alumni Merchant Scholarship	U. of Northern Iowa	2004 & 2006
Purple & Old Gold Award for Meritorious Achievement in Physics	U. of Northern Iowa	2004
Materials Research Science & Engineering Center Fellowship	U. of Nebraska	2003
McKay Science, Math, and Technology Scholarship	U. of Northern Iowa	2002
Science Symposium Physics Scholarship	U. of Northern Iowa	2001
Eagle Scout Award		1999

### Talks

Star & Planet Formation Seminar, STScl, Baltimore, MD <b>(Invited)</b>	August 2014
JPL Astrophysics Colloquium, Pasadena, CA <b>(Invited)</b>	July 2014
Sagan Exoplanet Summer Workshop, Caltech, Pasadena, CA <b>(Invited)</b>	July 2014
National Capital Area Disks Meeting, Carnegie DTM, Washington, DC	July 2014
“On the Shoulders of Giants: Planets Beyond the Reach of Kepler” AAS Meeting-in-a-Meeting <b>(Invited)</b>	June 2014
ATLAST Team Meeting, STScl, Baltimore, MD	April 2014

Exoplanet Club, NASA GSFC, Greenbelt, MD	February 2014
AURA Beyond JWST Committee Meeting <b>(Invited)</b>	January 2014
ATLAST Team Meeting, NASA GSFC, Greenbelt, MD	January 2014
223 <sup>rd</sup> AAS Meeting, National Harbor, MD	January 2014
Star & Planet Formation Seminar, STScl, Baltimore, MD <b>(Invited)</b>	November 2013
ATLAST Team Meeting, NASA GSFC, Greenbelt, MD <b>(Invited)</b>	November 2013
U. of Northern Iowa Physic Colloquium, Cedar Falls, IA <b>(Invited)</b>	April 2013
221 <sup>st</sup> AAS Meeting, Long Beach, CA	January 2013
National Capital Area Disks Meeting, STScl, Baltimore, MD	July 2012
NASA GSFC Extrasolar Planets Seminar, NASA GSFC, Greenbelt, MD	September 2011
Carnegie DTM Seminar, Carnegie DTM, Washington, D.C.	June 2011
NASA Exoplanet Exploration Program Analysis Group (ExoPAG) Meeting 4, Alexandria, VA <b>(Invited)</b>	June 2011
218 <sup>th</sup> AAS Meeting, Boston, MA	May 2011
Signposts of Planets Workshop, NASA GSFC, Greenbelt, MD <b>(Invited)</b>	April 2011
Computational Astrophysics Seminar, NASA GSFC, Greenbelt, MD <b>(Invited)</b>	December 2010
DTM Astronomy Group Meeting, Carnegie DTM, Washington, D.C.	October 2010
Advanced School and Workshop on Computational Gravitational Dynamics, Lorentz Center, Leiden, Netherlands <b>(Invited)</b>	May 2010
215 <sup>th</sup> AAS Meeting, Washington, D.C.	January 2010
Solar, Stellar, & Planetary Sciences (SSP) Seminar, Harvard-Smithsonian CfA, Cambridge, MA	November 2009
Planetary Astronomy Lunch Series, University of Maryland, College Park, MD	October 2009
41 <sup>st</sup> AAS DPS Meeting, Fajardo, Puerto Rico	October 2009
Wunch Talk, Princeton University, Princeton, NJ	September 2009
2 <sup>nd</sup> Exozodiacal Dust Disks and Darwin Meeting, International Space Science Institute, Bern, Switzerland <b>(Invited)</b>	April 2009
National Capital Area Disks Meeting, University of Maryland, College Park, MD <b>(Invited)</b>	January 2009
Star & Planet Formation Seminar, STScl, Baltimore, MD	January 2009
213 <sup>th</sup> AAS Meeting, Long Beach, CA	January 2009
NASA Graduate Student Researchers Program (GSRP) Fellowship Symposium, NASA GSFC, Greenbelt, MD	September 2008
Exoplanet Forum, Pasadena, CA	May 2008
National Capital Area Disks Meeting, Carnegie DTM, Washington, D.C.	December 2007
Exozodiacal Dust Disks and Darwin Meeting, International Space Science Institute, Bern, Switzerland <b>(Invited)</b>	August 2007
The Spirit of Lyot Meeting, UC Berkeley, Berkeley, CA	June 2007

38 <sup>th</sup> AAS DDA Meeting, University of Michigan, Ann Arbor, MI	May 2007
Unjournal Club, University of Maryland, College Park, MD	April 2007
Exoplanet Club, NASA GSFC, Greenbelt, MD	March 2007
Nearby Resolved Debris Disks Workshop, STScl, Baltimore, MD	October 2005

## Press

Featured interview on <i>Naked Astronomy</i> Podcast	October 25, 2010
NASA press release “Dust Models Paint Alien’s View of Solar System” picked up by hundreds of media outlets and accompanying video received 100,000+ hits	September 23, 2010
Featured on JPL PlanetQuest home page, regarding observations of 51 Oph disk	October 15, 2009
Featured on NExScl home page, regarding observations of 51 Oph disk	September 24, 2009
Featured in W.M. Keck Observatory press release, regarding observations of 51 Oph disk	September 24, 2009
NASA press release “NASA Supercomputer Shows How Dust Rings Point to Exo-Earths” picked up by 100+ media outlets	October 10, 2008
Debris disk simulation featured on cover of <i>Nature</i>	July 6, 2006

## Service

Served on NASA ROSES proposal review committee	2013
Organized and led Carnegie DTM astronomy journal club meetings	2011 – 2012
Served on NASA Postdoctoral Program applications review committee	2011 – 2012
Scientific Organizing Committee & Local Organizing Committee Member for Signposts of Planets Conference	October 2011
Scientific Organizing Committee & Local Organizing Committee Member for Signposts of Planets Workshop	April 2011
Informal mentor to UMD graduate student Maxime Rizzo	2010
Organized NASA GSFC circumstellar disks group meeting	2006 – 2010
Referee for <i>Astronomy &amp; Astrophysics</i>	
Referee for <i>The Astrophysical Journal</i>	

## Outreach

Volunteer Carnegie DTM staffer at USA Science Festival	April 2012
Co-authored cover story for <i>Astronomy Magazine</i>	August 2010
Organized & led tour of NASA GSFC for International OSA Network of Students	September 2009
Judge at Greenbelt Elementary School Science Fair	February 2009

Judge at Physics/Astronomy Spotlight on Graduate Research Competition at the University of Maryland College Park	December 2008
Volunteer NASA staffer at Smithsonian Folk Life Festival	July 2008
Science advisor for Maryland Science Center Planetarium show “Beyond the Planets”	2006
Volunteer physics department staffer at Maryland Day festival at the University of Maryland College Park	2005 & 2006

## Teaching Experience

Graduate Teaching Assistant, U. of Maryland Dept. of Physics <i>Vibrations, Waves, Heat, Electricity &amp; Magnetism Laboratory</i> <i>Electrodynamics, Light, Relativity &amp; Modern Physics Laboratory</i>	2004 – 2007 Fall 2007 Fall 2004 & Spring 2005
Graduate Teaching Assistant, U. of Maryland Dept. of Astronomy <i>Introduction to Astronomy</i>	2005 Fall 2005
Undergraduate Teaching Assistant, U. of Northern Iowa Dept. of Physics <i>Physics for Scientists &amp; Engineers Laboratory</i> <i>Modern Physics</i> <i>Introductory Physics Courses</i>	2002 – 2004 Spring 2004 Fall 2003 Fall 2002 & Spring 2003

## Publications in Refereed Journals

**C. C. Stark**, A. Roberge, A. Mandell, & T. D. Robinson “Maximizing the ExoEarth Candidate Yield from a Future Direct Imaging Mission,” *Astrophysical Journal*, in press.

G. Schneider, C. A. Grady, D. C. Hines, **C. C. Stark**, J. H. Debes, J. Carson, M. J. Kuchner, M. D. Perrin, A. J. Weinberger, J. P. Wisniewski, M. D. Silverstone, H. Jang-Condell, T. Henning, B. E. Woodgate, E. Serabyn, A. Moro-Martin, M. Tamura, P. M. Hinz, & T. J. Rodigas “Probing for Exoplanets Hiding in Dusty Debris Disks: Disk Imaging, Characterization, and Exploration with HST/STIS Multi-Roll Coronagraphy,” *Astronomical Journal*, **148**, 59 (2014).

**C. C. Stark**, G. Schneider, A. J. Weinberger, J. H. Debes, C. A. Grady, H. Jang-Condell, & M. J. Kuchner “Revealing Asymmetries in the HD 181327 Debris Disk: A Recent Massive Collision or ISM Warping,” *Astrophysical Journal*, **789**, 58 (2014).

B. Jackson, **C. C. Stark**, E. R. Adams, J. Chambers, & D. Deming “A Survey for Very Short-period Planets in the Kepler Data,” *Astrophysical Journal*, **779**, 165 (2013).

**C. C. Stark**, A. P. Boss, A. J. Weinberger, B. K. Jackson, M. Endl, W. Cochran, C. Caldwell, E. Agol, E. Ford, J. Li, K. Ibrahim, & J. Hall “A Search for Exozodis with Kepler,” *Astrophysical Journal*, **764**, 195 (2013).

J. Debes, K. Walsh, & **C. C. Stark** “The Link Between Planetary Systems, Dusty White Dwarfs, and Metal Polluted White Dwarfs,” *Astrophysical Journal*, **747**, 148 (2012).

**C. C. Stark** “The Transit Light Curve of an Exozodiacal Dust Cloud,” *Astronomical Journal*, **142**, 123 (2011).

R. Millan-Gabet, E. Serabyn, B. Mennesson, W. A. Traub, R. K. Barry, W. C. Danchi, M. Kuchner, **C. C. Stark**, S. Ragland, M. Hrynevych, J. Woillez, K. Stapelfeldt, G. Bryden, M. M. Colavita, A. J. Booth “Exozodiacal Dust Levels for Nearby Main-sequence Stars: A Survey with the Keck Interferometer Nuller,” *Astrophysical Journal* **734**, 67 (2011).

M. Reidemeister, A. V. Krivov, **C. C. Stark**, J.-C. Augereau, T. Löhne, & S. Müller “The Cold Origin of the Warm Dust Around  $\epsilon$  Eridani,” *Astronomy & Astrophysics* **527**, 57 (2011).

M. J. Kuchner & **C. C. Stark** “Collisional Grooming Models of the Kuiper Belt Dust Cloud,” *Astronomical Journal* **140**, 1007 (2010).

D. Defrère, O. Absil, R. den Hartog, C. Hanot & **C. Stark** “Nulling Interferometry: Impact of Exozodiacal Clouds on the Performance of Future Life-Finding Space Missions,” *Astronomy & Astrophysics* **509**, 9 (2010).

**C. C. Stark** & M. J. Kuchner “A New Algorithm for Self-Consistent 3-D Modeling of Collisions in Dusty Debris Disks,” *Astrophysical Journal* **707**, 543 (2009).

**C. C. Stark**, et al. “51 Ophiuchus: A Possible Beta Pictoris Analog Measured with the Keck Interferometer Nuller,” *Astrophysical Journal* **703**, 1188 (2009).

**C. C. Stark** & M. J. Kuchner, “The Detectability of Exo-Earths and Super-Earths Via Resonant Signatures in Exozodiacal Clouds,” *Astrophysical Journal* **686**, 637 (2008).

P. M. Shand, **C. Stark**, D. S. Williams, M. A. Morales, T. M. Pekarek, and D. L. Leslie-Pelecky, “Spin Glass or Random Anisotropy?: The Origin of Magnetically Glassy Behavior in Nanostructured  $\text{GdAl}_2$ ,” *Journal of Applied Physics* **97**, 10J505-1-3 (2005).

M. A. Morales, D. S. Williams, P. M. Shand, **C. Stark**, T. M. Pekarek, L. P. Yue, V. Petkov, and D. L. Leslie-Pelecky, “Disorder-Induced Depression of the Curie Temperature in Mechanically Milled  $\text{GdAl}_2$ ,” *Physical Review B* **70**, 184407-1–8 (2004).

**C. Stark**, P.M. Shand, T.M. Pekarek, D. Williams, R. Brown, L. Yue, and D.L. Leslie-Pelecky, “Coexistence of Ferromagnetic and Glassy States in Mechanically Milled  $\text{GdAl}_2$ ,” *American Journal of Undergraduate Research* **1**, 27 (2002).

### Proceedings & White Papers

P. Stahl, M. Postman, G. Mosier, S.W. Smith, C. Blaurock, H. Kong, & **C. Stark**, “AMTD: Update of Engineering Specifications Derived from Science Requirements for Future UVOIR Space Telescopes,” *Space Telescopes and Instrumentation 2014: Optical, Infrared, and Millimeter Wave SPIE Proceedings* **9143**, 91431T-1 (2014).

- D. Defrère, **C. Stark**, K. Cahoy, & I. Beerer, “Direct imaging of exoEarths embedded in clumpy debris disks,” *Space Telescopes and Instrumentation 2012: Optical, Infrared, and Millimeter Wave SPIE Proceedings* **8442**, 88420-M1 (2012).
- D. Defrère, O. Absil, R. den Hartog, C. Hanot & **C. Stark**, “Influence of Exozodiacal Dust Clouds on Mid-IR Earth-like Planet Detection,” *Pathways Towards Habitable Planets ASPC Proceedings* **430**, 422 (2010).
- O. Absil, D. Defrère, A. Roberge, J.-C. Augereau, V. Coudé Du Foresto, C. Hanot, **C. Stark**, & J. Surdej, “Direct Imaging of Earth-like Planets: Why We Care About Exozodis,” *Optical and Infrared Interferometry II SPIE Proceedings* **7734**, 77340L (2010).
- M. J. Kuchner & **C. C. Stark**, “Collisional Grooming of Debris Disks,” *Exoplanets & Disks: Their Formation and Diversity AIP Conference Proceedings* **1158**, 47 (2009).
- J. Kasting, W. A. Traub, et al. “Exoplanet Characterization and the Search for Life,” *White Paper for Decadal Survey* (2009).
- A. Roberge, et al. “Understanding Habitability and Characterizing ExoEarths: The Role of Debris Disks,” *White Paper for Decadal Survey* (2009).
- D. Leisawitz, et al. “Characterizing Extrasolar Planetary Systems,” *White Paper for Decadal Survey* (2009).
- P. R. Lawson, W. A. Traub, S. C. Unwin, et al. “2008 Exoplanet Forum Report,” *JPL Publication 09-3* (2009).
- M. J. Kuchner, **C. C. Stark**, O. Absil, J.-C. Augereau, & P. Thebault, “Dynamics of Exozodiacal Clouds,” *arXiv:0707.1280v1*, *White Paper* (2007).