

Tommi Koskinen

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Employment

Assistant Professor

Lunar and Planetary Laboratory, University of Arizona

Associate Staff Scientist

Lunar and Planetary Laboratory, University of Arizona, 2014–2017

Post-Doctoral Research Associate

Lunar and Planetary Laboratory, University of Arizona, 2009–2014

Education

PhD in Astrophysics, University College London, 2008

Thesis title: *The Stability of Short-Period Extrasolar Giant Planets*

Supervisors: Prof. Alan D. Aylward, Dr. Serena Viti

MSci in Astrophysics (First Class Honours), University College London, 2003

Project Report: *Modelling Infrared Emission from Planet Forming Dusty Disks*

Research Interests

Planetary science, planetary atmospheres, extrasolar planets, plasma physics, viscous and compressible fluid dynamics, numerical methods, gaskinetic theory, planetary ionospheres, global circulation models, radiative transfer applications, stellar high energy emissions

Grants and Awards

NASA NFDAP NNH16ZDA001N (PI): Atmospheric structure and escape on Pluto, 2018-2019

NASA XRP NNH17ZDA001N (Co-I): The middle atmospheres of exoplanets, 2018-2020

NASA APRA NNX17AI84G (Co-I): Colorado Ultraviolet Transit Experiment: Mass loss and magnetic fields in exoplanetary systems, 2017–2021

STScI HST-GO-15338.003 (Co-I): NUV spectroscopy of HD189733b: Measuring the mass-loss and ionization state of a prototypical escaping atmosphere, 2018–2019

Jet Propulsion Laboratory (JPL) subcontract (Co-PI): Saturn working group discipline legacy products: Density structure in Saturn's upper atmosphere, 2017–2018

Jet Propulsion Laboratory (JPL) subcontract (Co-PI): Saturn's upper atmosphere for the Grand Finale, 2016–2017

STScI HST-GO-13859.002-A (Co-I, Admin-PI): Unveiling the circumstellar environment of the most extreme hot Jupiters, 2015–2018

NASA CDAP NNX14AD51G (PI): Characterizing the density and temperature structure in the upper atmospheres of Saturn and Titan, 2014–2017

NASA CDAP NNX13AJ06G (PI): Characterizing the density and temperature profiles in the upper atmosphere of Saturn, 2013–2014

Jet Propulsion Laboratory (JPL) subcontract (PI): Analysis of stellar occultations by Saturn observed by the Cassini/UVIS instrument in preparation for the end of the Cassini Solstice (XXM) mission, 2012–2013

Jon Darius Memorial Prize for Outstanding Postgraduate Research in Astronomy, University College London, 2008

Invited talks

Cassini Project Science Group (PSG) Meeting plenary talks

- PSG #74, March 2018, Rome, Italy:

Densities in Saturn's thermosphere: A multi-instrument perspective

- PSG #71, February 2017, Monrovia, CA:

UVIS/CIRS constraints on Saturn's He abundance

- PSG #69, June 2016, ESTEC, Noordwijk, Netherlands:

The detection of benzene in Saturn's upper atmosphere

- PSG #65, January 2015, Italian Space Agency (ASI), Rome, Italy:

The expansion and contraction of Saturn's thermosphere

- PSG #63, June 2014, ESTEC, Noordwijk, Netherlands:

Saturn's upper atmosphere from Cassini/UVIS occultations

American Geophysical Union (AGU) Fall Meeting 2014, San Francisco, CA

Title: *Electrodynamics in giant planet atmospheres*

Characterizing stellar and exoplanetary environments 2013, International Space Science Institute (ISSI), Bern, Switzerland (via Skype)

Title: *Giants playing with fire – The story of thermal atmospheric escape*

Royal Society Discussion Meeting 2013, Characterizing exoplanets: detection, formation, interiors, atmospheres and habitability, London, UK

Title: *Thermal escape from extrasolar giant planets*

AGU Fall Meeting 2012, San Francisco, CA

Title: *The escape of exoplanetary atmospheres under strong irradiation*

Characterizing stellar and exoplanetary environments 2012, ISSI, Bern, Switzerland

Title: *Characterizing the upper atmosphere of HD209458b*

Modeling Atmospheric Escape 2012, University of Virginia, Charlottesville, Virginia

Title: *Interpreting the observations of the upper atmospheres of extrasolar planets*

European Planetary Science Congress (EPSC) and Division of Planetary Sciences (DPS) Joint Meeting 2011, Nantes, France

Title: *Titan's upper atmosphere revealed by Cassini/UVIS stellar occultations*

Poster (invited): *Comparative aeronomy of HD209458b and HD189733b*

Royal Astronomical Society National Astronomy Meeting 2008, Belfast, UK

Title: *Simulations of Extrasolar Giant Planet Thermospheres in 3D*

Cumberland Lodge Meeting 2008: Exploration of the Solar System, Windsor Great Park, UK

Title: *Exoplanetary Atmospheres and their Dynamics*

Conferences & Meetings

DPS Meeting 2017, Provo, Utah

Talk: *Constraints on atmospheric structure and helium abundance of Saturn from Cassini/UVIS and CIRS*

DPS/EPSC Meeting 2016, Pasadena, California

Talk: *New observational constraints on hydrocarbon chemistry in Saturn's upper atmosphere*

DPS Meeting 2015, National Harbor, Maryland

Poster: *Predictions for the escape of CH₄ from Pluto*

EPSC 2015, Nantes, France

Talk: *Variability in Saturn's upper atmosphere from Cassini/UVIS occultations*

DPS Meeting 2014, Tucson, Arizona

Talk: *Saturn's variable thermosphere from Cassini/UVIS occultations*

Saturn Science Conference: Saturn in the 21st century, August 2014, Madison, Wisconsin

Talk: *Saturn's variable thermosphere. Part 1: The view from UV occultations*

Cassini/UVIS team meeting, June 2014, Berlin, Germany

Talk: *Saturn's upper atmosphere*

Cassini PSG meetings #59, #60, #61, #63, #67 (Saturn working group), 2013–2015, JPL, La Canada Flintridge, California & Uppsala, Sweden & ESTEC, Noordwijk, Netherlands

Talks: *Saturn's upper atmosphere from Cassini UVIS*

DPS Meeting, 2013, Denver, Colorado

Talk: *The thermosphere of Saturn from Cassini UVIS occultations*

DPS Meeting, 2012, Reno, Nevada

Poster: *Temperature and density structure in Saturn's thermosphere from Cassini/UVIS solar occultations*

UV Astronomy: HST and Beyond, 2012, Kaua'i, Hawai'i

Talk: *Characterizing the atmospheres of extrasolar planets with UV transit observations*

Titan Science Meeting, 2011, Abbaye Saint Jacut-de-la-Mer, France

Talk: *Recent results from analysis of UVIS stellar occultations*

Cassini PSG meeting 54, 2011 (Titan working group), ESA/ESTEC, Noordwijk, Netherlands

Talk: *Recent results from analysis of UVIS stellar occultations*

Cassini PSG meeting 52, 2010 (Titan working group), JPL, La Canada Flintridge, California

Talk: *New perspectives on the upper atmosphere of Titan from Cassini UVIS stellar occultations*

DPS Meeting, 2010, Pasadena, California

Talk: *New perspectives on the upper atmosphere of Titan from Cassini UVIS stellar occultations*

EPSC 2010, Rome, Italy

Talk: *Thermospheres of extrasolar giant planets*

Molecules 2008, Paris, France
Talk: *A 3D Model for the Upper Atmospheres and Ionospheres of Extrasolar Giant Planets*

EPSC 2008, Potsdam, Germany
Talk: *3D Simulations of the Upper Atmosphere and Ionosphere of HD17156b*

EPSC 2007, Berlin, Germany
Talk: *Thermospheres of Extrasolar Giant Planets*

Seminars

Jet Propulsion Laboratory, May 2017, Pasadena, CA
Title: *Cool giants and hot exoplanets: Adventures in upper atmospheres*

Department of Physics and Astronomy, George Mason University, March 2017, Fairfax County, VA
Title: *Thermal escape from hot extrasolar planets*

Center for Space Physics, Boston University, March 2014, Boston, MA
Title: *Sunsets on Saturn – A new perspective on the upper atmosphere from Cassini/UVIS occultations*

Groupe de Spectrométrie Moléculaire et Atmosphérique, Université Reims Champagne-Ardenne, December 2012, Reims, France
Title: *Characterizing planetary upper atmospheres with UV observations (and models)*

Institute de Planétologie et d'Astrophysique de Grenoble, Université de Grenoble, March 2012, Grenoble, France
Title: *Characterizing the upper atmospheres of extrasolar planets*

Department of Physics and Astronomy, University College London, September 2010, London, UK
Title: *Thermospheres of extrasolar giant planets*

Refereed publications

Gröller, H., Montmessin, F., Yelle, R., Lefevre, F., Forget, F., Schneider, N., **Koskinen, T. T.**, Deighan, J., Jain, S. K., *MAVEN/IUVS stellar occultation measurements of Mars atmospheric structure and composition*, JGR: Planets, 123 (2018)

Cui, J., Zhao, L.-L., Yelle, R. V., Zhao, L.-L., Stone, S., Jiang, F.-Y., Cao, Y.-T., Yao, M.-J., **Koskinen, T. T.**, Wei, Y., *The impact of crustal magnetic fields on the thermal structure of the Martian upper atmosphere*, ApJ, 853, L33 (2018)

Koskinen, T. T., Guerlet, S., *Atmospheric structure and helium abundance on Saturn from Cassini/UVIS and CIRS observations*, Icarus, **307**, 161–171 (2018)

Fossati, L., **Koskinen, T. T.**, France, K., Cubillos, P. E., Haswell, C. A., Lanza, A. F., Pillitteri, I., *Suppressed Far-UV stellar activity and low planetary mass loss in the WASP-18 system*, ApJ, 155, 113 (2018)

Fleming, B., France, K., Nell, N., Kohnert, R., Pool, K., Egan, A., Fossati, L., **Koskinen, T. T.**, Vidotto, A., Hoadley, K., Desert, J.-M., Beasley, M., Petit, P., *The Colorado Ultraviolet Transit Experiment (CUTE): A dedicated cubesat mission to study exoplanetary mass loss and magnetic fields*, JATIS, 4, 014004 (2018)

- Chadney, J. M., **Koskinen, T. T.**, Galand, M., Unruh, Y. C., Sanz-Forcada, J., *Effect of stellar flares on the upper atmospheres of HD189733b and HD209458b*, A&A, **608**, A75 (2017)
- Lavvas, P., **Koskinen, T. T.**, *Aerosol properties in the atmospheres of extra-solar giant planets*, ApJ, 847, 32 (2017)
- García Muñoz, A., **Koskinen, T. T.**, Lavvas, P., *Upper atmospheres and ionospheres of planets and satellites*, in ‘Handbook of Exoplanets’ (eds. H. J. Deeg, J. A. Belmonte), Springer International Publishing AG (2017)
- Fossati, L., et al., *On the effects of ISM absorption on stellar activity measurements and its relevance for exoplanet studies*, A&A, 601, A104 (2017)
- Parke Loyd, R. O., **Koskinen, T. T.**, France, K., Schneider, C., Redfield, S., *Ultraviolet C II and Si III transit spectroscopy and modeling of the evaporating atmosphere of GJ436b*, Astrophys. J., 834, L17 (2017)
- Strobel, D. F., **Koskinen, T. T.**, Müller-Wodarg, I. C. F., *Saturn’s variable thermosphere*, in ‘Saturn in the 21st century’ (editor K. Baines), accepted, arXiv:1610.07669.
- Koskinen, T. T.**, Moses, J. I., West, R. A., Guerlet, S., Jouchoux, A., *The detection of benzene in Saturn’s upper atmosphere*, Geophys. Res. Lett., **43**, 7895–7901 (2016)
- Cui, J., Cao, Y.-T., Lavvas, P., **Koskinen, T. T.**, *The variability of HCN in Titan’s upper atmosphere as implied by the Cassini Ion-Neutral Mass Spectrometer measurements*, Astrophys. J., **826**, L5 (2016)
- Chadney, J. M., Galand, M., **Koskinen, T. T.**, Miller, S., Sanz-Forcada, J., Unruh, Y. C., Yelle, R. V., *EUV-driven Ionospheres and electron transport on extrasolar giant planets orbiting active stars*, A&A, **587**, A87 (2016)
- Capalbo, F. J., Bénilan, Y., Fray, N., Schwell, M., Champion, N., Es-sebbar, Et., **Koskinen, T. T.**, Lehoccki, I., Yelle, R. V., *New benzene absorption cross sections in the VUV, relevance for Titan’s upper atmosphere*, Icarus, **265**, 95–109 (2016)
- Gröller, H., Yelle, R. V., **Koskinen, T. T.**, et al., *Probing the Martian atmosphere with MAVEN/IUVS stellar occultations*, GRL, **42**, 9064–9070 (2015)
- Tinetti, G., et al., *The EChO science case*, Exp. Astron., **40**, 329–391 (2015)
- Fossati, L., France, K., **Koskinen, T. T.**, Juvan, I. G., Haswell, C. A., Lendl, M., *Far-UV spectroscopy of the planet-hosting star WASP-13: high energy irradiance, distance, age, planetary mass loss rate, and circumstellar environment*, ApJ, **815**, 118 (2015)
- Capalbo, F. J., Bénilan, Y., Yelle, R. V., **Koskinen, T. T.**, *Titan’s upper atmosphere from Cassini/UVIS solar occultations*, ApJ, **814**, 86 (2015)
- Koskinen, T. T.**, Erwin, J. T., Yelle, R. V., *On the escape of CH₄ from Pluto*, GRL, **42**, 7200–7205 (2015)
- Koskinen, T. T.**, Sandel, B. R., Yelle, R. V., Strobel, D. F., Müller-Wodarg, I. C. F., Erwin, J., *Saturn’s variable thermosphere from Cassini/UVIS occultations*, Icarus, **260**, 174–189 (2015)

- Sandel, B. R., Gröller, H., Yelle, R. V., **Koskinen, T. T.**, et al., *Altitude profiles of O₂ on Mars from SPICAM stellar occultations*, *Icarus*, **252**, 154–160 (2015)
- Chadney, J., Galand, M., Unruh, Y., **Koskinen, T. T.**, Sanz-Forcada, J., *XUV-driven mass loss from extrasolar giant planets orbiting active stars*, *Icarus*, **250**, 357–367 (2015)
- Koskinen, T. T.**, Yelle, R. V., Lavvas, P., Cho, J-Y. K., *Electrodynamics on extrasolar giant planets*, *ApJ*, **796**, 16 (2014)
- Lavvas, P., **Koskinen, T. T.**, Yelle, R. V., *Electron densities and alkali atoms in exoplanet atmospheres*, *ApJ*, **796**, 15 (2014)
- Koskinen, T. T.**, Lavvas, P., Harris, M. J., Yelle, R. V., *Thermal escape from extrasolar giant planets*, *Phil. Trans. R. Soc. A*, **372**, 20130089 (2014)
- Koskinen, T. T.**, Sandel, B. R., Yelle, R. V., Capalbo, F. J., Holsclaw, G. E., McClintock, W. E., Edgington, S., *The density and temperature structure near the exobase of Saturn from Cassini/UVIS solar occultations*, *Icarus*, **226**, 1318–1330 (2013)
- Koskinen, T. T.**, Harris, M. J., Yelle, R. V., Lavvas, P., *The escape of heavy atoms from the ionosphere of HD209458b. I. A photochemical-dynamical model of the thermosphere*, *Icarus*, **226**, 1678–1694 (2013)
- Koskinen, T. T.**, Yelle, R. V., Harris, M. J., Lavvas, P., *The escape of heavy atoms from the ionosphere of HD209458b. II. Interpretation of the observations*, *Icarus*, **226**, 1695–1708 (2013)
- Menager, H., Barthélemy, M., **Koskinen, T. T.**, Lilensten, J., Ehrenreich, D., Parkinson, C., *Calculation of the H Lyman α emission of the hot Jupiters HD209458b and HD189733b*, *Icarus*, **226**, 1709–1718 (2013)
- Capalbo, F. J., Benilan, Y., Yelle, R. V., **Koskinen, T. T.**, Sandel, B. R., Holsclaw, G. M., McClintock, W. E., *Solar occultation by Titan measured by Cassini/UVIS*, *ApJL*, **766**, L16, 5pp. (2013)
- Lavvas, P., Yelle, R. V., **Koskinen, T. T.**, et al., *Aerosol growth in Titan's ionosphere*, *PNAS*, **110**, 2729–2734 (2013)
- Cui, J., Yelle, R. V., Strobel, D. F., Müller-Wodarg, I. C. F., Snowden, D. S., **Koskinen, T. T.**, Galand, M., *The CH₄ structure in Titan's upper atmosphere revisited*, *J. Geophys. Res.*, **117**, E11006 (2012)
- Tinetti, G., et al., *EChO: Exoplanet Characterization Observatory*, *Exp. Astron.*, **34**, 311–353 (2012)
- Koskinen, T. T.**, Yelle, R. V., Snowden, D. S., Lavvas, P., Sandel, B. R., Capalbo, F. J., Benilan, Y., West, R. A., *The mesosphere and thermosphere of Titan revealed by Cassini/UVIS stellar occultations*, *Icarus*, **216**, 507–534 (2011)
- Koskinen, T. T.**, Cho, J. Y-K., Achilleos, N., Aylward, A. D., *Ionization of Extrasolar Giant Planet Atmospheres*, *ApJ*, **722**, 178–187 (2010)

Koskinen, T. T., Yelle, R. V., Lavvas, P., Lewis, N. K., *Characterizing the thermosphere of HD209458b with UV transit observations*, ApJ, **723**, 116-128 (2010)

Koskinen, T.T., Aylward, A.D., Miller, S., *The Upper Atmosphere of HD17156b*, ApJ, **693**, 868-885 (2009)

Koskinen, T.T., Aylward, A.D., Miller, S., *A Stability Limit for the Atmospheres of Giant Extrasolar Planets*, Nature, **450**, 845-848 (2007)

Koskinen, T.T., Aylward, A.D., Smith, C.G.A., Miller, S., *A Thermospheric Circulation Model for Extrasolar Giant Planets*, ApJ, **661**, 515-526 (2007)

In preparation

Müller-Wodarg, I. C. F., **Koskinen, T. T.**, Moore, L., Serigano, J., Yelle, R. V., Hörst, S., Waite, J. H., Mendillo, M., *Atmospheric waves and their effect on the thermal structure of Saturn's thermosphere*, submitted to GRL

Lothringer, J., Barman, T., **Koskinen, T.**, *Extremely irradiated Hot Jupiters: Non-oxide inversions, H^- opacity, and thermal dissociation of molecules*, submitted to ApJ

Yelle, R. V., Serigano, J., **Koskinen, T. T.**, Hörst, S., Perry, M. E., Cravens, T. E., Perryman, R. S., Hunter Waite, J. Jr., *Thermal structure and composition of Saturn's upper atmosphere from Cassini/INMS measurements*, submitted to GRL

Pryor, W. R., Esposito, L. W., Jouchoux, A., West, R. A., Grodent, D., Gerard, J.-C., Radioti, A., Lamy, L., **Koskinen, T.**, *Cassini UVIS detection of Saturn's north polar hexagon in the Grand Finale orbits*, in preparation

Vriesema, J., **Koskinen, T. T.**, Yelle, R. V., *Saturn's magnetic field perturbations at low latitudes*, in preparation

Koskinen, T. T., et al., *Saturn in Lyman α : A comparison of Voyager and Cassini observations*, in preparation

Service

Member of the Cassini Saturn Atmosphere Modeling Group (2014-2018)

Cassini Participating Scientist (2014-2017)

Reviewer for Icarus, Astrophysical Journal, Astronomy and Astrophysics, Canadian Journal of Physics, Planetary and Space Science, NASA proposal review panels, Space Telescope Science Institute Hubble fellowship panels

Teaching and advising

Faculty advisor to Zarah Brown (LPL, Arizona)

Advised and collaborated with post-docs H. Gröller, J. Erwin (LPL, Arizona) and PhD students J. Vriesema (LPL, Arizona), J. Lothringer (LPL, Arizona), K. Pearson (LPL, Arizona), M. Steinrueck (LPL, Arizona), R. O. Parke Loyd (University of Colorado), J. Chadney (Imperial, UK), F. J. Capalbo (LISA, France) and H. Menager (Grenoble, France) on projects related to solar system and exoplanets. Helped to supervise MSci student projects at University College London.

Outreach

Flandrau Planetarium, 2018, University of Arizona, Tucson, Arizona

Public talks: *What are hot Jupiters?*

Quail Creek Resort Community, 2015, Green Valley, Arizona

Public talk: *The new Copernican revolution: Discovery and characterization of extrasolar planets*

Finnfest USA 2012, Tucson, Arizona; Finnfest USA 2014, Minneapolis, Minnesota

Public talk: *The myth and science of the northern lights: From the land of Santa Claus to distant exoplanets*

University College London Astronomy Diploma Club 2007, London, UK

Public talk: *Extrasolar Giant Planets and the Stability of Their Atmospheres*

References

Available on request