

Dr. Travis Barman

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Brief Research Interest Statement:

My research delves into both theoretical and observational aspects of extrasolar planets. As a lead developer of the PHOENIX model atmosphere code, I am responsible for maintaining and expanding its abilities to predict and interpret the atmospheric properties of exoplanets and brown dwarfs. My theoretical work is used extensively in ground-based direct-imaging planet search programs, in particular as a lead co-investigator for the new Gemini Planet Imager Survey. I am also heavily involved in programs focused on spectroscopy of extrasolar planets, from transiting to directly imaged. By comparing theoretical model spectra to real photometric and spectroscopic observations, a variety of planet properties can be deduced. Atmospheric structure (horizontal and vertical run of temperature and pressure), surface gravities, chemical composition, and global wind patterns are a few examples of the kinds of planet properties we seek through model-observation comparisons.

Employment:

2013–present Associate Professor (University of Arizona)
2012–2013 Astronomer (Lowell Observatory)
2006–2012 Assistant Astronomer (Lowell Observatory)
2004–2006 Postdoctoral Research Associate
(UCLA Astronomy Dept.)
2002–2004 Postdoctoral Research Associate
(Wichita State University)

Education:

1996 – 2002 Ph.D. Physics
University of Georgia (Supervisor: Dr. Peter H. Hauschildt)
1991 – 1996 B.S. Mathematics and B.S. Physics/Astronomy
University of Georgia

Honors and Awards:

2010 AAAS Newcomb Cleveland Prize (for the direct imaging of exoplanets)
2008 Beatrice M. Tinsley Visiting Scholar (Univ. of Texas, Austin)
2002 James L. Carmon Scholarship
2002 The Cummings Award for Outstanding Graduate Student and Teaching Assistant
1995 L. L. Hendren Scholarship for Outstanding Physics Student
1995 Ted L. Simons Award for Outstanding Physics Student

Professional Services:

- Hubble Space Telescope Panel (1 term)
- NOAO Solar System panel (5 terms)
- Spitzer Panel (2 terms)
- NASA Astrophysics Theory Panelist
- NASA Origins of Solar Systems Panelist (2 terms)
- NASA Kepler Participating Scientist Panelist
- NSF AAG Panelist
- External reviewer for NASA Origins and EPSCOR programs
- External reviewer for Gemini CTAC
- Referee for ApJ, MNRAS, and A&A

Talks and Colloquia (2010 – present):

The Crown Jewels of Young Eoplanets: 2014, Sagan Summer Workshop

Modeling Brown Dwarf and Exoplanet Spectra (review): 2014, Exoclines 3

Exoplanet Atmospheres and Direct Spectroscopy: 2013, Exoplanet and Disks

Characterizing the Atmospheres of Transiting Planets: 2013, LPL University of Arizona

Direct Imaging and Spectroscopy of Young Giant Planets: 2012, University of Montreal colloquium

Direct Imaging and Spectroscopy of Young Giant Planets: 2012, University of Western Ontario colloquium

Guest speaker for “Planets, Life and the Universe” lecture series: 2012, JHU & STScI

Modeling Exoplanet Atmospheres: 2011, Workshop on General Circulation Models applied to Exoplanets, University of Exeter

Atmospheric Properties of the Young Planets 2M1207b and HR8799 b&c: 2011, JPL colloquium

Atmospheric Properties of the Young Planets 2M1207b and HR8799 b&c: 2011, Caltech/NExSci colloquium

Giant Planet Atmospheres Review: 2011 Exploring Strange New Worlds Conference

Atmospheric Properties Of The Young Exoplanets HR 8799 b & c: 2011, Winter AAS meeting

Modeling the Atmospheres and Evolution of Exoplanets: 2010, Spirit of Lyot Conference

Age Indicators for Brown Dwarfs: 2010, Cool Stars 16

The Young Planets Orbiting HR8799. 2010, Institute for Astrophysics, University of Hawaii

The Young Planets Orbiting HR8799. 2010, Kavli Institute for Theoretical Physics

Publications

Publications in refereed journals:

Konopacky, Q. M., **Barman, T. S.**, Macintosh, B. A., Marois, C. 2013. *Detection of Carbon Monoxide and Water Absorption Lines in an Exoplanet Atmosphere*. Science 339, 1398-1401.

Beichman, C., Gelino, C. R., Kirkpatrick, J. D., **Barman, T. S.**, Marsh, K. A., Cushing, M. C., Wright, E. L. 2013. *The Coldest Brown Dwarf (or Free-floating Planet)?: The Y Dwarf WISE 1828+2650*. The Astrophysical Journal 764, 101.

Crossfield, I. J. M., **Barman, T.**, Hansen, B. M. S., Tanaka, I., Kodama, T. 2012. *Re-evaluating WASP-12b: Strong Emission at 2.315 microns, Deeper Occultations, and an Isothermal Atmosphere*. The Astrophysical Journal 760, 140.

Vigan, A., and 10 colleagues 2012. *The International Deep Planet Survey. I. The frequency of wide-orbit massive planets around A-stars*. Astronomy and Astrophysics 544, A9.

Jensen, A. G., Redfield, S., Endl, M., Cochran, W. D., Koesterke, L., **Barman, T.** 2012. *A Detection of $H\alpha$ in an Exoplanetary Exosphere*. The Astrophysical Journal 751, 86.

Konopacky, Q. M., Ghez, A. M., Fabrycky, D. C., Macintosh, B. A., White, R. J., **Barman, T. S.**, Rice, E. L., Hallinan, G., Duchêne, G. 2012. *Rotational Velocities of Individual Components in Very Low Mass Binaries*. The Astrophysical Journal 750, 79.

Bailey, J. I., III, White, R. J., Blake, C. H., Charbonneau, D., **Barman, T. S.**, Tanner, A. M., Torres, G. 2012. *Precise Infrared Radial Velocities from Keck/NIRSPEC and the Search for Young Planets*. The Astrophysical Journal 749, 16.

Zhao, M., Milburn, J., **Barman, T.**, Hinkley, S., Swain, M. R., Wright, J., Monnier, J. D. 2012. *Detection of K_S -band Thermal Emission from WASP-3b*. The Astrophysical Journal 748, L8.

Bailey, J. I., III, White, R. J., Blake, C. H., Charbonneau, D., **Barman, T. S.**, Tanner, A. M., Torres, G. 2012. *Precise Infrared Radial Velocities from Keck/NIRSPEC and the Search for Young Planets*. The Astrophysical Journal, in press.

Crossfield, I. J. M., Hansen, B. M. S., **Barman, T. S.** 2012. *Ground-based, Near-infrared Exospectroscopy. II. Tentative Detection of Emission from the Extremely Hot Jupiter WASP-12b*. The Astrophysical Journal 746, 46.

Zhao, M., Monnier, J. D., Swain, M. R., **Barman, T. S.**, Hinkley, S. 2012. *Ground-based Detections of Thermal Emission from CoRoT-1b and WASP-12b*. The Astrophysical Journal 744, 122.

Jensen, A. G., Redfield, S., Endl, M., Cochran, W. D., Koesterke, L., **Barman, T. S.** 2011. *A Survey of Alkali Line Absorption in Exoplanetary Atmospheres*. The Astrophysical Journal 743, 203.

- Galicher, R., Marois, C., Macintosh, B., **Barman, T.**, Konopacky, Q. 2011. *M-band Imaging of the HR 8799 Planetary System Using an Innovative LOCI-based Background Subtraction Technique*. The Astrophysical Journal 739, L41.
- Anderson, D. R., Smith, A. M. S., Lanotte, A. A., **Barman, T. S.**, et al. 2011. *Thermal emission at 4.5 and 8 μ m of WASP-17b, an extremely large planet in a slightly eccentric orbit*. Monthly Notices of the Royal Astronomical Society 416, 2108-2122.
- Crossfield, I. J. M., **Barman, T. S.**, Hansen, B. M. S. 2011. *High-resolution, Differential, Near-infrared Transmission Spectroscopy of GJ 1214b*. The Astrophysical Journal 736, 132.
- Witte, S., Helling, C., **Barman, T. S.**, Heidrich, N., Hauschildt, P. H. 2011. *Dust in brown dwarfs and extra-solar planets. III. Testing synthetic spectra on observations*. Astronomy and Astrophysics 529, A44.
- Barman, T. S.**, Macintosh, B., Konopacky, Q. M., Marois, C., 2011. *Clouds and Chemistry in the Atmosphere of Extrasolar Planet HR 8799 b*. The Astrophysical Journal, 733, 65
- Barman, T. S.**, Macintosh, B., Konopacky, Q. M., Marois, C., 2011. *The Young Planet-mass Object 2M1207b: A Cool, Cloudy, and Methane-poor Atmosphere*. The Astrophysical Journal, 735, 39
- Marois, C., Zuckerman, B., Konopacky, Q. M., Macintosh, B., **Barman, T. S.** 2010. *Images of a fourth planet orbiting HR 8799*. Nature, 468, 7327
- Kirkpatrick, J. D., and 14 colleagues 2010. *Discoveries from a Near-infrared Proper Motion Survey Using Multi-epoch Two Micron All-Sky Survey Data*. The Astrophysical Journal Supplement Series 190, 100-146.
- Anderson, D. R., Gillon, M., Maxted, P. F. L., **Barman, T. S.**, Collier Cameron, A., Hellier, C., Queloz, D., Smalley, B., Triaud, A. H. M. J. 2010. *H-band thermal emission from the 19-h period planet WASP-19b*. Astronomy and Astrophysics 513, L3.
- Konopacky, Q. M., Ghez, A. M., **Barman, T. S.**, Rice, E. L., Bailey, J. I., White, R. J., McLean, I. S., Duchêne, G. 2010. *High-precision Dynamical Masses of Very Low Mass Binaries*. The Astrophysical Journal 711, 1087-1122.
- Beichman, C. A., Krist, J., Trauger, J. T., Greene, T., Oppenheimer, B., Sivaramakrishnan, A., Doyon, R., Boccaletti, A., **Barman, T. S.**, Rieke, M. 2010. *Imaging Young Giant Planets From Ground and Space*. Publications of the Astronomical Society of the Pacific 122, 162-200.
- Gillon, M., and 18 colleagues 2010. *The thermal emission of the young and massive planet CoRoT-2b at 4.5 and 8 μ m*. Astronomy and Astrophysics 511, A3.
- Barnes, J. R., **Barman, T. S.**, Jones, H. R. A., Barber, R. J., Hansen, B. M. S., Prato, L., Rice, E. L., Leigh, C. J., Cameron, A. C., Pinfield, D. J. 2010. *A search for molecules in the atmosphere of HD 189733b*. Monthly Notices of the Royal Astronomical Society 401, 445-454.
- Rice, E. L., **Barman, T. S.**, Mclean, I. S., Prato, L., Kirkpatrick, J. D. 2010. *Physical Properties of Young Brown Dwarfs and Very Low Mass Stars Inferred from High-resolution Model Spectra*. The Astrophysical Journal Supplement Series 186, 63-84.

- Lavigne, J.-F., Doyon, R., Lafrenière, D., Marois, C., **Barman, T. S.** 2009. *Near-Infrared Observations of GQ Lup b Using the Gemini Integral Field Spectrograph NIFS*. The Astrophysical Journal 704, 1098-1106.
- Leconte, J., Baraffe, I., Chabrier, G., **Barman, T. S.**, Levrard, B. 2009. *Structure and evolution of the first CoRoT exoplanets: probing the brown dwarf/planet overlapping mass regime*. Astronomy and Astrophysics 506, 385-389.
- Gillon, M., Demory, B.-O., Triaud, A. H. M. J., **Barman, T. S.**, Hebb, L., Montalbán, J., Maxted, P. F. L., Queloz, D., Deleuil, M., Magain, P. 2009. *VLT transit and occultation photometry for the bloated planet CoRoT-1b*. Astronomy and Astrophysics 506, 359-367.
- Wawrzyn, A. C., **Barman, T. S.**, Günther, H. M., Hauschildt, P. H., Exter, K. M. 2009. *Structure and spectra of irradiated secondaries in close binaries. A model calculation of the pre-cataclysmic variable UU Sagittae*. Astronomy and Astrophysics 505, 227-237.
- Hauschildt, P. H., Warmbier, R., Schneider, R., **Barman, T. S.** 2009. *Methane line opacities in very cool stellar objects*. Astronomy and Astrophysics 504, 225-229.
- Hügelmeier, S. D., Dreizler, S., Hauschildt, P. H., Seifahrt, A., Homeier, D., **Barman, T. S.** 2009. *Radiative transfer in circumstellar disks. I. 1D models for GQ Lupi*. Astronomy and Astrophysics 498, 793-800.
- Lafrenière, D., Marois, C., Doyon, R., **Barman, T. S.** 2009. *HST/NICMOS Detection of HR 8799 b in 1998*. The Astrophysical Journal 694, L148-L152.
- Kirkpatrick, J. D., and 11 colleagues 2008. *A Sample of Very Young Field L Dwarfs and Implications for the Brown Dwarf "Lithium Test" at Early Ages*. The Astrophysical Journal 689, 1295-1326.
- Marois, C., Macintosh, B., **Barman, T. S.**, Zuckerman, B., Song, I., Patience, J., Lafrenière, D., Doyon, R. 2008. *Direct Imaging of Multiple Planets Orbiting the Star HR 8799*. Science 322, 1348.
- Barnes, J. R., **Barman, T. S.**, Jones, H. R. A., Leigh, C. J., Cameron, A. C., Barber, R. J., Pinfield, D. J. 2008. *HD179949b: a close orbiting extrasolar giant planet with a stratosphere?*. Monthly Notices of the Royal Astronomical Society 390, 1258-1266.
- Charbonneau, D., Knutson, H. A., **Barman, T. S.**, Allen, L. E., Mayor, M., Megeath, S. T., Queloz, D., Udry, S. 2008. *The Broadband Infrared Emission Spectrum of the Exoplanet HD 189733b*. The Astrophysical Journal 686, 1341-1348.
- Looper, D. L., and 11 colleagues 2008. *Discovery of Two Nearby Peculiar L Dwarfs from the 2MASS Proper-Motion Survey: Young or Metal-Rich?*. The Astrophysical Journal 686, 528-541.
- Gillon, M., Demory, B.-O., **Barman, T. S.**, Bonfils, X., Mazeh, T., Udry, S., Mayor, M., Queloz, D. 2008. *Accurate Spitzer infrared radius measurement for the hot Neptune GJ 436b*. Astronomy and Astrophysics 490, L1-L1.
- Mason, E., Howell, S. B., **Barman, T. S.**, Szkody, P., Wickramasinghe, D. 2008. *VV Puppis in a low state: secondary-star irradiation or stellar activity?*. Astronomy and Astrophysics 490, 279-286.

- Huélamo, N., and 14 colleagues 2008. *TW Hydrae: evidence of stellar spots instead of a Hot Jupiter*. *Astronomy and Astrophysics* 489, L9-L13.
- Hauschildt, P. H., **Barman, T. S.**, Baron, E. 2008. *Irradiated planets*. *Physica Scripta Volume T* 130, 014033.
- Zuckerman, B., and 17 colleagues 2008. *Gas and Dust Associated with the Strange, Isolated Star BP Piscium*. *The Astrophysical Journal* 683, 1085-1103.
- Schaefer, G. H., Simon, M., Prato, L., **Barman, T. S.** 2008. *Preliminary Orbit of the Young Binary Haro 1-14c*. *The Astronomical Journal* 135, 1659-1668.
- Baraffe, I., Chabrier, G., **Barman, T. S.** 2008. *Structure and evolution of super-Earth to super-Jupiter exoplanets. I. Heavy element enrichment in the interior*. *Astronomy and Astrophysics* 482, 315-332.
- Barman, T. S.** 2008. *On the Presence of Water and Global Circulation in the Transiting Planet HD 189733b*. *The Astrophysical Journal* 676, L61-L64.
- Hansen, B. M. S., **Barman, T. S.** 2007. *Two Classes of Hot Jupiters*. *The Astrophysical Journal* 671, 861-871.
- Demory, B.-O., and 13 colleagues 2007. *Characterization of the hot Neptune GJ 436 b with Spitzer and ground-based observations*. *Astronomy and Astrophysics* 475, 1125-1129.
- Barnes, J. R., **Barman, T. S.**, Prato, L., Segransan, D., Jones, H. R. A., Leigh, C. J., Collier Cameron, A., Pinfield, D. J. 2007. *Limits on the 2.2- μ m contrast ratio of the close-orbiting planet HD 189733b*. *Monthly Notices of the Royal Astronomical Society* 382, 473-480.
- Ferguson, J. W., Heffner-Wong, A., Penley, J. J., **Barman, T. S.**, Alexander, D. R. 2007. *Grain Physics and Rosseland Mean Opacities*. *The Astrophysical Journal* 666, 261-266.
- Gillon, M., Demory, B.-O., **Barman, T. S.**, Bonfils, X., Mazeh, T., Pont, F., Udry, S., Mayor, M., Queloz, D. 2007. *Accurate Spitzer infrared radius measurement for the hot Neptune GJ 436b*. *Astronomy and Astrophysics* 471, L51-L54.
- Barnes, J. R., Leigh, C. J., Jones, H. R. A., **Barman, T. S.**, Pinfield, D. J., Collier Cameron, A., Jenkins, J. S. 2007. *Near-infrared spectroscopic search for the close orbiting planet HD 75289b*. *Monthly Notices of the Royal Astronomical Society* 379, 1097-1107.
- Barman, T. S.** 2007. *Identification of Absorption Features in an Extrasolar Planet Atmosphere*. *The Astrophysical Journal* 661, L191-L194.
- Close, L. M., and 12 colleagues 2007. *The Wide Brown Dwarf Binary Oph 1622-2405 and Discovery of a Wide, Low-Mass Binary in Ophiuchus (Oph 1623-2402): A New Class of Young Evaporating Wide Binaries?*. *The Astrophysical Journal* 660, 1492-1506.
- Siegler, N., Close, L. M., Burgasser, A. J., Cruz, K. L., Marois, C., Macintosh, B., **Barman, T. S.** 2007. *Discovery of a 66 mas Ultracool Binary with Laser Guide Star Adaptive Optics*. *The Astronomical Journal* 133, 2320-2326.
- Marois, C., Macintosh, B., **Barman, T. S.** 2007. *GQ Lup B Visible and Near-Infrared Photometric Analysis*. *The Astrophysical Journal* 654, L151-L154.

- Marley, M. S., Fortney, J., Seager, S., **Barman, T. S.** 2007. *Atmospheres of Extrasolar Giant Planets*. Protostars and Planets V 733-747.
- Chabrier, G., Baraffe, I., Selsis, F., **Barman, T. S.**, Hennebelle, P., Alibert, Y. 2007. *Gaseous Planets, Protostars, and Young Brown Dwarfs: Birth and Fate*. Protostars and Planets V 623-638.
- Kirkpatrick, J. D., **Barman, T. S.**, Burgasser, A. J., McGovern, M. R., McLean, I. S., Tinney, C. G., Lowrance, P. J. 2006. *Discovery of a Very Young Field L Dwarf, 2MASS J01415823-4633574*. The Astrophysical Journal 639, 1120-1128.
- Barman, T. S.**, Hauschildt, P. H., Allard, F. 2005. *Phase-Dependent Properties of Extrasolar Planet Atmospheres*. The Astrophysical Journal 632, 1132-1139.
- Baraffe, I., Chabrier, G., **Barman, T. S.**, Selsis, F., Allard, F., Hauschildt, P. H. 2005. *Hot-Jupiters and hot-Neptunes: A common origin?*. Astronomy and Astrophysics 436, L47-L51.
- Ferguson, J. W., Alexander, D. R., Allard, F., **Barman, T. S.**, Bodnarik, J. G., Hauschildt, P. H., Heffner-Wong, A., Tamanai, A. 2005. *Low-Temperature Opacities*. The Astrophysical Journal 623, 585-596.
- Schwarz, G. J., **Barman, T. S.**, Silvestri, N., Szkody, P., Starrfield, S., Vanlandingham, K., Wagner, R. M. 2004. *Quiescent Observations of the WZ Sagittae-Type Dwarf Nova PQ Andromedae*. Publications of the Astronomical Society of the Pacific 116, 1111-1116.
- Barman, T. S.**, Hauschildt, P. H., Allard, F. 2004. *Model Atmospheres for Irradiated Stars in Precataclysmic Variables*. The Astrophysical Journal 614, 338-348.
- Baraffe, I., Selsis, F., Chabrier, G., **Barman, T. S.**, Allard, F., Hauschildt, P. H., Lammer, H. 2004. *The effect of evaporation on the evolution of close-in giant planets*. Astronomy and Astrophysics 419, L13-L16.
- Chabrier, G., **Barman, T. S.**, Baraffe, I., Allard, F., Hauschildt, P. H. 2004. *The Evolution of Irradiated Planets: Application to Transits*. The Astrophysical Journal 603, L53-L56.
- Baraffe, I., Chabrier, G., **Barman, T. S.**, Allard, F., Hauschildt, P. H. 2003. *Evolutionary models for cool brown dwarfs and extrasolar giant planets. The case of HD 209458*. Astronomy and Astrophysics 402, 701-712.
- Barman, T. S.**, Hauschildt, P. H., Schweitzer, A., Stancil, P. C., Baron, E., Allard, F. 2002. *Non-LTE Effects of Na I in the Atmosphere of HD 209458b*. The Astrophysical Journal 569, L51-L54.
- Barman, T. S.**, Hauschildt, P. H., Allard, F. 2001. *Irradiated Planets*. The Astrophysical Journal 556, 885-895.
- Barman, T. S.**, Hauschildt, P. H., Short, C. I., Baron, E. 2000. *A Grid of Non-LTE Model Atmospheres for White Dwarfs in Cataclysmic Variables*. The Astrophysical Journal 537, 946-952.