

# Curriculum Vitae

Prof. Dr. Kevin Heng

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## Research Interests

Theory, simulation and phenomenology of exoplanetary atmospheres: fluid dynamics, radiative transfer, chemistry, inversion methods. Analytical methods in astrophysics. Applications of high performance computing. Exoplanet science for CHEOPS, JWST and LUVOIR missions. Habitability: geochemical cycles and biosignatures. Pedagogy and epistemology.

Group Leader: Exoplanets & Exoclimates Group (4 postdocs, 4 Ph.D students)

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## 1. Training, Education and Awards

### 1.1. Academic Positions

2016–present: Director, Center for Space and Habitability, University of Bern

2015–present: Professor<sup>1</sup>, University of Bern

2013–2015: Tenure-Track Assistant Professor, University of Bern

2010–2012: Zwicky Prize Fellow, ETH Zürich, Institute for Astronomy

2009–2010: Frank & Peggy Taplin Member, Institute for Advanced Study at Princeton

2007–2009: Member, Institute for Advanced Study at Princeton

### 1.2. Visiting Positions

2017: Visiting Professor, Johns Hopkins University, Departments of Physics & Astronomy and Earth & Planetary Sciences

2007: Visitor, Max Planck Institutes for Astrophysics (MPA) and Extraterrestrial Physics (MPE)

### 1.3. Education

2007: Ph.D, astrophysics, JILA and University of Colorado at Boulder

2006: Chef Track Diploma, Culinary School of the Rockies, Colorado

2005: M.S., astrophysics, JILA and University of Colorado at Boulder

2003: B.Sc (Hons), physics, National University of Singapore

### 1.4. Awards, Honours & Prizes

2015: NCU-Delta Young Astronomer Lecturership Award

2007: Martin & Beate Block Prize, Aspen Center for Physics

2003, 2004, 2006: Graduate Fellowship (Departmental), University of Colorado at Boulder

2002: Pre-Graduate Award, Agency for Science, Technology and Research, Singapore

2000: Dean's List, National University of Singapore

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<sup>1</sup>The official title is *Ausserordentlicher Professor* in the Swiss-German system, which is the equivalent of Associate Professor (with tenure) in the American system. I have not listed “Associate Professor” as the University of Bern uses this title at a level equivalent to *Titular Professor* (Research Professor).

*CV of Prof. Dr. Kevin Heng*

*October 2, 2017*

### 1.5. Grants

2018–present: Project 3.1 Leader, PlanetS NCCR (National Center of Competence in Research), Swiss National Science Foundation (PI: W. Benz)

2016: Swiss National Science Foundation grant for the Exoplanets I conference [5 kCHF]

2014–present: Swiss National Science Foundation, for the *Exoclimes Simulation Platform* [373 + 363 kCHF]

2014–2018: Sub-Project 5.2 Leader, PlanetS NCCR (National Center of Competence in Research), Swiss National Science Foundation (PI: W. Benz)

2013–2020: Startup funding from the University of Bern [225 kCHF]

2014–2016: Swiss National Science Foundation grant for the Exoclimes III conference [6 kCHF]

2012–2016: FONDATION MERAC, Switzerland, for the *Exoclimes Simulation Platform* [500 kCHF]

2006: Sigma Xi, *Grants-in-Aid of Research* [1.5 kUSD]

### 1.6. Significant Mentors & Influences

Richard McCray, Scott Tremaine, Sara Seager, Willy Benz, Rashid Sunyaev, George Lake, Helmer Aslaksen

## 2. Service

### 2.1. Teaching Experience

2016: Invited lecturer, DPG Physics School on Exoplanets, Bad Honnef, Germany

2014–present: Advisor for 5 postdocs, 5 Ph.D students and 1 Masters student, Physics Institute, University of Bern

2013–present: Lecturer (with rank of habilitated Professor) for 7 Masters<sup>2</sup> and 1 undergraduate courses, Physics Institute, University of Bern

2012, 2014: Host/advisor for ThinkSwiss Research Scholarship summer students (Peter Li, Greta Shum)

2011–2012: Supervision of 6 students for semester projects, Institute for Astronomy, ETH Zürich

2003–2006: Graduate teaching assistant, introductory astronomy/astrophysics, University of Colorado at Boulder

### 2.2. Referee/Reviewer

#### 2.2.1. Grant Reviewer

2017: Winton Exoplanet Fellowships, Winton Philanthropies (U.K.)

2016–2017: European Research Council (ERC)

2016–2017: German Research Foundation (Deutsche Forschungsgemeinschaft or DFG)

2016: Leverhulme Trust (U.K.)

2016: Hubble Space Telescope (HST)

2014: Netherlands Organisation for Scientific Research (NWO)

2014–2017: NASA Exoplanets Research Program (XRP)

2013, 2015: NASA Postdoctoral Program (NPP)

2013: Swiss National Science Foundation (SNSF)

2013: (U.S.) National Science Foundation (NSF) *TCAN* Program

2013–2014: French National Research Agency (ANR)

2013–2015: Research Foundation - Flanders (FWO)

2012: (British) Royal Society *University Research Fellowship* Program

2012: U.S.-Israel Binational Science Foundation

2012, 2014, 2016: NASA Astrophysics Theory Program (ATP)

2012–2013: NASA ROSES Origins of Solar Systems Program

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<sup>2</sup>Fluid Dynamics ×3, Radiative Transfer ×2, Planetary Atmospheres ×2.

### 2.2.2. Journal Editor

2015–present: Handling Editor, *Molecular Astrophysics* (Editor-in-Chief: A. Tielens)

### 2.2.3. Journal Referee

2016–present: *Nature Astronomy*

2016–present: *Nature*

2013–present: *Science*

2012–present: *Planetary & Space Science*

2012–present: *Astronomical Journal*

2011–present: *Monthly Notices of the Royal Astronomical Society*

2008–present: *Astronomy & Astrophysics*

2006–present: *Astrophysical Journal*

### 2.3. Missions and Telescopes

2017–present: TESS mission Atmospheric Characterization Working Group

2017–present: Ex-officio non-voting international member (representing Switzerland), Science and Technology Definition Team (STDT), Large Ultraviolet/Optical/Infrared Surveyor (LUVOIR) space telescope

2016–present: Science team, SAINT-Ex telescope (PI: B.-O. Demory)

2014–present: University of Bern representative for the HIRES spectrograph on the E-ELT

2013–present: PLATO mission (PI: H. Rauer) approved by ESA

2012–present: Core science team, CHEOPS mission (PI: W. Benz) approved by ESA

2012: EChO mission proposed to ESA

### 2.4. Committees

2017–2018: SOC member, Exoplanets II conference, Cambridge University, England

2017–present: tenure review evaluations for 3 universities

2017–present: Swiss National Science Foundation (SNSF) Ambizione Fellowship selection committee

2016: Ph.D thesis committee of Pierre Auclair-Desrotour, Paris Observatory, France

2016–present: Science Committee member, International Space Science Institute (ISSI)

2015: SOC member, OHP (Observatoire de Haute Provence) conference

2015: SOC member, PLATO atmospheric science workshop, DLR Berlin

2014–2016: SOC and LOC chair, Exoplanets I conference, Davos, Switzerland

2014–2015: SOC member and LOC chair, Pathways to Habitability II, Bern, Switzerland

2014: Ph.D thesis committee of Monika Lendt, Geneva Observatory, Switzerland

2012–2014: SOC member and LOC chair, Exoclimates III conference, Davos, Switzerland

2011: External Opponent (Ph.D thesis examiner), DARK Cosmology Centre, Copenhagen, Denmark

### 2.5. Societies

2016–present: Clé de Berne

2014–2016: Treasurer, Swiss Society for Astronomy & Astrophysics (SSAA)

2012–present: World Minds (formerly Zürich Minds until 2016)

2012–present: Member, International Astronomical Union (IAU)

2006–present: Member, Sigma Xi: The Scientific Research Society

### 2.6. Outreach

2015–2016: Member, board of advisors, Swiss Space Museum

2014: *Nova: Alien Planets Revealed*, PBS, Season 41, Episode 10, directed by N. Williams and B. Bowie, with contributions from N. Batalha, D. Charbonneau, K. Heng, G. Marcy, C. McKay, S. Seager et al.

2013–present: Columnist, *Perspective* (formerly *Marginalia*) section of *American Scientist* magazine

### 2.7. Selected Grants for Telescope Time (as Consulting Theorist/Phenomenologist)

2016: *A Preparatory Program to Identify the Single Best Transiting Exoplanet for JWST Early Release Science*, Hubble Space Telescope, Co-I (PI: Stevenson), Cycle 24

2015: *Hot Exoplanet Atmospheres Resolved with Transit Spectroscopy (HEARTS)*, ESO 3.6m (HARPS), Co-I (PI: Ehrenreich), Period 96

2012: *Atmospheric composition and inflation of the “warm” Jupiter WASP-80b*, VLT-CRIRES, Co-I (PI: Triaud), Period 91

2012: *Full-orbit atmospheric characterisation of a gas giant transiting an M dwarf*, Spitzer Space Telescope, Co-I (PI: Triaud), Cycle 9

2012: *Measuring the albedo of HD 189733b at optical wavelengths*, Hubble Space Telescope, Co-I (PI: Pont), Cycle 20

2009–2012: *IFU observations of shocks in SN 1006*, VLT-VIMOS, Co-I, Periods 85 (PI: van de Ven) and 89 (PI: Nikolić)

2006–2009, 2013: *Multi-band imaging and spectroscopy of SN 1987A*, Hubble Space Telescope, Co-I (PI: Kirshner or Fransson), SAINTS team, Cycles 15–18, 21 & 24

### 2.8. Other Professional Experiences

1998–1999: Journalist, producer and sound engineer, Power 98.0 FM, Singapore

1997–1998: Logistics specialist, infantry division, Singapore Armed Forces

## 3. Publications

### 3.1. Graduate-Level Textbook

*Exoplanetary Atmospheres: Theoretical Concepts and Foundations*, K. Heng, 2017, Princeton University Press (Editor: Ingrid Gnerlich. Foreword by Sara Seager.)

### 3.2. Refereed/Peer-Reviewed Papers (since 2005)

**33 first author (5 single author), 7 second author, 10 third author, 23 N-th author ( $N > 3$ ), 5 last author (as PI). Citations: 2000+. h-index: 26 (using ADS).**

78. *Combining low- to high-resolution transit spectroscopy of HD189733b*, L. Pino et al., 2017, *Astronomy & Astrophysics*, in press (arXiv:1709.09678)
77. *Retrieval Analysis of the Emission Spectrum of WASP-12b: Sensitivity of Outcomes to Prior Assumptions and Implications for Formation History*, M. Oreshenko et al., 2017, *Astrophysical Journal Letters*, 847, L3
76. *The long egress of GJ 436b giant exosphere*, B. Lavie et al. 2017, *Astronomy & Astrophysics*, 605, L7
75. *Analytical Models of Exoplanetary Atmospheres. IV. Improved Two-stream Radiative Transfer for the Treatment of Aerosols*, K. Heng & D. Kitzmann, 2017, *Astrophysical Journal Supplements*, 232, 20
74. *Balmer filaments in Tycho’s supernova remnant: an interplay between cosmic-ray and broad-neutral precursors*, S. Knežević et al. 2017, *Astrophysical Journal*, 846, 167
73. *How does the Shape of the Stellar Spectrum affect the Albedo of Exoplanets at Short Optical Wavelengths?*, A. Oklopčić, C.M. Hirata & K. Heng, 2017, *Astrophysical Journal*, 846, 91
72. *Community targets for JWST’s early release science program: evaluation of WASP-63b*, B.M. Kilpatrick et al. 2017, *Astrophysical Journal*, submitted (arXiv:1704.07421)

71. *Habitable Moist Atmospheres on Terrestrial Planets Near the Inner Edge of the Habitable Zone Around M-Dwarfs*, R.K. Kopparapu et al., 2017, *Astrophysical Journal*, 845, 5
70. *Radiative Transfer for Exoplanet Atmospheres*, K. Heng & M. Marley, 2017, *Handbook of Exoplanets*, eds. H.J. Deeg, J.A. Belmonte, S. Seager (Springer) (arXiv:1706.03188)
69. *Secondary atmospheres on HD 219134 b and c*, C. Dorn & K. Heng, 2017, *Astronomy & Astrophysics*, submitted
68. *A seven-planet resonant chain in TRAPPIST-1*, R. Luger et al., 2017, *Nature Astronomy*, 1, 129
67. *The theory of transmission spectra revisited: a fast method for analyzing WFC3 data and an unresolved challenge*, K. Heng & D. Kitzmann, 2017, *Monthly Notices of the Royal Astronomical Society*, 470, 2972
66. *HELIOS-Retrieval: An Open-source, Nested Sampling Atmospheric Retrieval Code, Application to the HR 8799 Exoplanets and Inferred Constraints for Planet Formation*, B. Lavie et al., 2017, *Astronomical Journal*, 154, 91
65. *Exoplanet Characterization by Multi-Observatory Transit Photometry with TESS and CHEOPS*, E. Gaidos, D. Kitzmann & K. Heng, *Monthly Notices of the Royal Astronomical Society*, 468, 3418
64. *Hot Exoplanet Atmospheres Resolved with Transit Spectroscopy (HEARTS) I. Detection of hot neutral sodium at high altitudes on WASP-49b*, A. Wyttenbach et al. 2017, *Astronomy & Astrophysics*, 602, A36
63. *VULCAN: an Open-Source, Validated Chemical Kinetics Python Code for Exoplanetary Atmospheres*, S.-M. Tsai et al., 2017, *Astrophysical Journal Supplements*, 228, 20
62. *HELIOS: An Open-Source, GPU-Accelerated Radiative Transfer Code For Self-Consistent Exoplanetary Atmospheres*, M. Malik et al., 2017, *Astronomical Journal*, 153, 56
61. *A Generalized Bayesian Inference Method for Constraining the Interiors of Super Earths and Sub-Neptunes*, C. Dorn et al., 2017, *Astronomy & Astrophysics*, 597, A37
60. *Three-dimensional Distribution of Ejecta in Supernova 1987A at 10,000 Days*, J. Larsson et al., 2016, *Astrophysical Journal*, 833, 147
59. *THOR: A New and Flexible Global Circulation Model to Explore Planetary Atmospheres*, J.M. Mendonça et al., 2016, *Astrophysical Journal*, 829, 115
58. *Raman Scattering by Molecular Hydrogen and Nitrogen in Exoplanetary Atmospheres*, A. Oklopčić, C.M. Hirata & K. Heng, 2016, *Astrophysical Journal*, 832, 30
57. *A Cloudiness Index for Transiting Exoplanets Based on the Sodium and Potassium Lines: Tentative Evidence for Hotter Atmospheres Being Less Cloudy at Visible Wavelengths*, K. Heng, 2016, *Astrophysical Journal Letters*, 826, L16
56. *Analytical Models of Exoplanetary Atmospheres. III. Gaseous C-H-O-N Chemistry with 9 Molecules*, K. Heng & S.-M. Tsai, 2016, *Astrophysical Journal*, 829, 104
55. *A map of the extreme day-night temperature gradient of a super-Earth exoplanet*, B.-O. Demory et al., 2016, *Nature*, 532, 207
54. *Transiting Exoplanet Studies and Community Targets for JWST's Early Release Science Program*, K.B. Stevenson et al., 2016, *Publications of the Astronomical Society of the Pacific*, 128, 967

53. *Shear-driven instabilities and shocks in the atmospheres of hot Jupiters*, S. Fromang, J. Leconte & K. Heng, *Astronomy & Astrophysics*, 2016, 591, A144
52. *Planet Hunters X. KIC 8462852 — Where's the Flux?*, T.S. Boyajian et al., 2016, *Monthly Notices of the Royal Astronomical Society*, 457, 3988
51. *Optical phase curves as diagnostics for aerosol composition in exoplanetary atmospheres*, M. Oreshenko, K. Heng & B.-O. Demory, 2016, *Monthly Notices of the Royal Astronomical Society*, 457, 3420
50. *Carbon Dioxide in Exoplanetary Atmospheres: Rarely Dominant Compared to Carbon Monoxide and Water in Hot, Hydrogen-dominated Atmospheres*, K. Heng & J.R. Lyons, 2016, *Astrophysical Journal*, 817, 149
49. *Atmospheric Chemistry for Astrophysicists: A Self-consistent Formalism and Analytical Solutions for Arbitrary C/O*, K. Heng, J.R. Lyons & S.-M. Tsai, 2016, *Astrophysical Journal*, 816, 96
48. *The unstable CO<sub>2</sub> feedback cycle on ocean planets*, D. Kitzmann et al., 2015, *Monthly Notices of the Royal Astronomical Society*, 452, 3752
47. *HELIOS-K: An Ultrafast, Open-source Opacity Calculator for Radiative Transfer*, S.L. Grimm & K. Heng, 2015, *Astrophysical Journal*, 808, 182
46. *The Destruction of the Circumstellar Ring of SN 1987A*, C. Fransson et al., 2015, *Astrophysical Journal Letters*, 806, L19
45. *WASP-80b has a dayside within the T-dwarf range*, A.H.M.J. Triaud et al., 2015, *Monthly Notices of the Royal Astronomical Society*, 450, 2279
44. *A Non-isothermal Theory for Interpreting Sodium Lines in Exoplanetary Atmospheres*, K. Heng, A. Wyttenbach, B. Lavie, D.K. Sing, D. Ehrenreich & C. Lovis, 2015, *Astrophysical Journal Letters*, 803, L9
43. *Mapping High-velocity H $\alpha$  and Ly $\alpha$  Emission from Supernova 1987A*, K. France et al., 2015, *Astrophysical Journal Letters*, 801, L16
42. *Can we constrain the interior structure of rocky exoplanets from mass and radius measurements?*, C. Dorn, A. Khan, K. Heng, Y. Alibert, J.A.D. Connolly, W. Benz & P. Tackley, 2015, *Astronomy & Astrophysics*, 577, A83
41. *Atmospheric Dynamics of Hot Exoplanets*, K. Heng & A.P. Showman, 2015, *Annual Review of Earth and Planetary Sciences*, 43, 509
40. *High Resolution Transmission Spectroscopy as a Diagnostic for Jovian Exoplanet Atmospheres: Constraints from Theoretical Models*, E. M.-R. Kempton, R. Perna & K. Heng, 2014, *Astrophysical Journal*, 795, 24
39. *Analytical Models of Exoplanetary Atmospheres. II. Radiative Transfer via the Two-Stream Approximation*, K. Heng, J.M. Mendonça & J.-M. Lee, 2014, *Astrophysical Journal Supplements*, 215, 4
38. *Analytical Models of Exoplanetary Atmospheres. I. Atmospheric Dynamics via the Shallow Water System*, K. Heng & J. Workman, 2014, *Astrophysical Journal Supplements*, 213, 27
37. *Constraining the Atmospheric Composition of the Day-Night Terminators of HD 189733b: Atmospheric Retrieval with Aerosols*, J.-M. Lee et al., 2014, *Astrophysical Journal*, 789, 14
36. *The PLATO 2.0 Mission*, H. Rauer et al., 2014, *Experimental Astronomy*, 38, 249

35. *Atmospheric Retrieval Analysis of the Directly Imaged Exoplanet HR 8799b*, J.-M. Lee, K. Heng & P.G.J. Irwin, 2013, *Astrophysical Journal*, 778, 97
34. *Understanding Trends Associated with Clouds in Irradiated Exoplanets*, K. Heng & B.-O. Demory, 2013, *Astrophysical Journal*, 777, 100
33. *Inference of Inhomogeneous Clouds in an Exoplanet Atmosphere*, B.-O. Demory et al., 2013, *Astrophysical Journal Letters*, 776, L25
32. *The Deep Blue Color of HD 189733b: Albedo Measurements with Hubble Space Telescope/Space Telescope Imaging Spectrograph at Visible Wavelengths*, T. Evans, et al., 2013, *Astrophysical Journal Letters*, 772, L16
31. *Debris discs around M stars: non-existence versus non-detection*, K. Heng & M. Malik, 2013, *Monthly Notices of the Royal Astronomical Society*, 452, 2562
30. *An Integral View of Fast Shocks around Supernova 1006* S. Nikolić, G. van de Ven, K. Heng, D. Kupko, B. Husemann, J.C. Raymond, J.P. Hughes & J. Falcón-Barroso, 2013, *Science*, 340, 45
29. *On the Existence of Shocks in Irradiated Exoplanetary Atmospheres*, K. Heng, 2012, *Astrophysical Journal Letters*, 761, L1
28. *On the Stability of Super Earth Atmospheres*, K. Heng & P. Kopparla, 2012, *Astrophysical Journal*, 754, 60
27. *The Effects of Irradiation on Hot Jovian Atmospheres: Heat Redistribution and Energy Dissipation*, R. Perna, K. Heng & F. Pont, 2012, *Astrophysical Journal*, 751, 59
26. *Excitation and charge transfer in hydrogen-proton collisions at 5–80 keV and application to astrophysical shocks*, D. Tseliakhovich, C.M. Hirata & K. Heng, 2012, *Monthly Notices of the Royal Astronomical Society*, 422, 2357
25. *The Influence of Atmospheric Scattering and Absorption on Ohmic Dissipation in Hot Jupiters*, K. Heng, 2012, *Astrophysical Journal Letters*, 748, L17
24. *EChO - Exoplanet Characterisation Observatory*, G. Tinetti et al., 2012, *Experimental Astronomy*, 34, 311
23. *On the effects of clouds and hazes in the atmospheres of hot Jupiters: semi-analytical temperature-pressure profiles*, K. Heng, W. Hayek, F. Pont & D.K. Sing, 2012, *Monthly Notices of the Royal Astronomical Society*, 420, 20
22. *HST-COS Observations of Hydrogen, Helium, Carbon and Nitrogen Emission from the SN 1987A Reverse Shock*, K. France et al., 2011, *Astrophysical Journal*, 743, 186
21. *Atmospheric circulation of tidally-locked exoplanets: II. Dual-band radiative transfer and convective adjustment*, K. Heng, D.M.W. Frierson & P.J. Phillipps, 2011, *Monthly Notices of the Royal Astronomical Society*, 418, 2669
20. *X-ray illumination of the ejecta of supernova 1987A*, J. Larsson et al., 2011, *Nature*, 474, 484
19. *Estimating the mass of the debris disk in HD 69830*, K. Heng, 2011, *Monthly Notices of the Royal Astronomical Society*, 415, 3365
18. *The Dependence of Brown Dwarf Radii on Metallicity and Clouds: Theory and Comparison with Observations*, A. Burrows, K. Heng & T. Nampaisarn, 2011, *Astrophysical Journal*, 736, 47

17. *Gliese 581g as a scaled-up version of Earth: atmospheric circulation simulations*, K. Heng & S.S. Vogt, 2011, Monthly Notices of the Royal Astronomical Society, 415, 2145
16. *Atmospheric circulation of tidally-locked exoplanets: a suite of benchmark tests for dynamical solvers*, K. Heng, K. Menou & P.J. Phillipps, 2011, Monthly Notices of the Royal Astronomical Society, 413, 2380
15. *Observing Supernova 1987A with the Refurbished Hubble Space Telescope*, K. France et al., 2010, Science, 329, 1624
14. *Vortices as Nurseries for Planetesimal Formation in Protoplanetary Discs*, K. Heng & S.J. Kenyon, 2010, Monthly Notices of the Royal Astronomical Society, 408, 1476
13. *Balmer-Dominated Shocks: A Concise Review*, K. Heng, 2010, Publications of the Astronomical Society of Australia, 27, 23
12. *Long-Lived Planetesimal Discs*, K. Heng & S. Tremaine, 2010, Monthly Notices of the Royal Astronomical Society, 401, 867
11. *Planetesimal Disk Microlensing*, K. Heng & C.R. Keeton, 2009, Astrophysical Journal, 707, 621
10. *Magnetohydrodynamic Shallow Water Waves: Linear Analysis*, K. Heng & A. Spitkovsky, 2009, Astrophysical Journal, 703, 1819
9. *Spatial Structure and Collisionless Electron Heating in Balmer-dominated Shocks*, M.I. van Adelsberg et al., 2008, Astrophysical Journal, 689, 1089
8. *A Direct Measurement of the Dust Extinction Curve in an Intermediate-Redshift Galaxy*, K. Heng et al., 2008, Astrophysical Journal, 681, 1116
7. *Probing Elemental Abundances in SNR 1987A using XMM-Newton*, K. Heng et al., 2008, Astrophysical Journal, 676, 361
6. *Broad Ly $\alpha$  Emission from Supernova Remnants*, K. Heng & R. Sunyaev, 2008, Astronomy & Astrophysics, 481, 117
5. *The Transition Zone in Balmer-Dominated Shocks*, K. Heng et al., 2007, Astrophysical Journal, 668, 275
4. *Dust Echoes from the Ambient Medium of Gamma-Ray Bursts*, K. Heng, D. Lazzati & R. Perna, 2007, Astrophysical Journal, 662, 1119
3. *Balmer-Dominated Shocks Revisited*, K. Heng & R. McCray, 2007, Astrophysical Journal, 654, 923
2. *Evolution of the Reverse Shock Emission from SNR 1987A*, K. Heng et al., 2006, Astrophysical Journal, 644, 959
1. *The Reverse Shock of SNR 1987A at 18 Years after Outburst*, N. Smith et al. 2005, Astrophysical Journal Letters, 635, L41



### 3.3. Conference Proceedings and White Papers

Note: conference abstracts are excluded

10. *Balmer-dominated shocks in Tycho's SNR: omnipresence of CRs*, Knežević, S. et al. 2017, Proceedings of the IAU Symposium, 331 (arXiv:1707.09026)
9. *The Need for Laboratory Work to Aid in The Understanding of Exoplanetary Atmospheres*, J.J. Fortney et al., 2016, Nexus for Exoplanet System Science (NExSS) (arXiv:1602.06305)
8. *Characterising exoplanets and their environment with UV transmission spectroscopy*, L. Fossati et al., 2015, Hubble's 2020 Vision (arXiv:1503.01278)
7. *HIRES: the high resolution spectrograph for the E-ELT*, F.M. Zerbi et al., 2014, Proceedings of the SPIE, 9147, 914723
6. *An Integral View of Balmer-dominated Shocks in Supernova Remnants*, S. Nikolić, G. van de Ven, Glenn, K. Heng, D. Kupko, J. Méndez-Abreu, J.A.L. Aguerri, J. Font Serra & J. Beckman, 2013, Proceedings of the IAU Symposium 296, 165
5. *The Exoplanet Characterization Observatory (EChO): performance model EclipseSim and applications*, R. van Boekel et al., 2012, Proceedings of the SPIE, 8442, 84421F
4. *The Science of EChO*, G. Tinetti et al., 2011, Proceedings of the IAU Symposium, 276, 359
3. *Challenges Facing Young Astrophysicists*, N. Zakamska et al., 2010, Astro2010: the Astronomy and Astrophysics Decadal Survey, Position Papers, no. 69
2. *The Reverse Shock of SNR 1987A*, K. Heng, 2007, American Institute of Physics Conference Proceedings, 937, 51, *Supernova 1987A: 20 Years After (Supernovae & Gamma-Ray Bursters)*, Aspen Center for Physics, eds. S. Immler, K.W. Weiler and R. McCray
1. *Bolocam: status and observations*, D.J. Haig et al., 2004, Proceedings of the SPIE, 5498, 78

### 3.4. Popular Science Articles

‡: edited by Katie Burke †: edited by Fenella Saunders

12. *Ozone-like layer in an exoplanet atmosphere*, K. Heng, 2017, Nature (News & Views), 548, 38
11. *A New Window on Alien Atmospheres*‡, K. Heng, 2017, American Scientist, Perspective Column, 105, 86–89
10. *The language of exoplanet ranking metrics needs to change*, E. Tasker et al., 2017, Nature Astronomy, 1, 42
9. *The Imprecise Search for Extraterrestrial Habitability*‡, K. Heng, 2016, American Scientist, Perspective Column, Volume 104, Number 3, Pages 146–149
8. *Auf der Jagd nach der zweiten Erde*, K. Heng (translated), 2016, Spektrum der Wissenschaft, April 2016 Issue, Pages 36–44
7. *La naturaleza de la prueba científica en la era de las simulaciones*, K. Heng (translated), 2015, Investigación y Ciencia, May 2015 Issue, Pages 42–46
6. *The Next Great Exoplanet Hunt*‡, K. Heng & J. Winn, 2015, American Scientist, Feature Article, Volume 103, Number 3, Pages 196–203

5. *The Nature of Scientific Proof in the Age of Simulations*<sup>‡</sup>, K. Heng, 2014, American Scientist, Perspective Column, Volume 102, Number 3, Pages 174–177
4. *Why Does Nature Form Exoplanets Easily?*<sup>†</sup>, K. Heng, 2013, American Scientist, Marginalia Column, Volume 101, Number 3, Pages 184–187
3. *Das Klima auf fremden Welten*, K. Heng (translated), 2013, Spektrum der Wissenschaft, February 2013 Issue, Pages 46–53
2. *Le climat des exoplanètes*, K. Heng (translated by Sean Bailly), 2012, Pour la Science, Volume 421, Pages 40–46
1. *The Study of Climate on Alien Worlds*<sup>†</sup>, K. Heng, 2012, American Scientist, Feature Article, Volume 100, Number 4, Pages 334–341

#### 4. Selected Colloquia, Seminars & Popular Talks

##### 4.1. Exoplanets

49. Invited keynote talk at the European Geophysical Union (EGU) Galileo conference, Azores, Portugal (2017)
48. *Atmospheric Chemistry in Currently Observable Exoplanets*, invited special seminar, Space Telescope Science Institute, U.S.A. (2017)
47. Invited session chair and talk at Astrochemistry Symposium, American Chemical Society National Meeting, Washington D.C., U.S.A. (2017)
46. *Radiative Transfer in Atmospheres: Early Mars and Exoplanets*, Randolph Bromery Special Seminar, Johns Hopkins University, U.S.A. (2017)
45. *Limitations to what we may infer from atmospheric spectra, and possible links to planet formation*, invited talk at the Kavli ExoFrontiers Symposium, Cambridge University, England (2017)
44. *Radiative Transfer in Exoplanetary Atmospheres*, invited lecture at the Wenner-Gren Foundations Symposium on Planetary Atmospheres, Stockholm, Sweden (2017)
43. *Exoplanetary Atmospheres*, Heidelberg Joint Astronomical Colloquium (invited), Germany (2017)
42. *Transmission Spectra of Exoplanetary Atmospheres*, invited colloquium at the Harvard Institute for Theory and Computation (ITC), Cambridge, U.S.A. (2017)
41. *Exoplanetary Atmospheres: Theoretical Concepts and Foundations*, invited luncheon talk at the Harvard Institute for Theory and Computation (ITC), Cambridge, U.S.A. (2017)
40. *Two-Stream Radiative Transfer in Exoplanetary Atmospheres*, invited astrophysics colloquium at MIT, Cambridge, U.S.A. (2017)
39. *Exoplanetary Atmospheres*, invited lecture at the Institute for Planets and Life, joint between Space Telescope Science Institute and Johns Hopkins University, U.S.A. (2016)
38. *Exoplanetary Atmospheres*, invited lecture at the Bad Honnef summer school on exoplanets, Germany (2016)

37. *A Path Towards Detecting Life Elsewhere in the Universe*, invited talk for World Minds, Clé de Berne<sup>3</sup>, Switzerland (2016)
36. *The Exoclines Simulation Platform*, NCU-Delta Lecture III, Academia Sinica Institute of Astronomy and Astrophysics (ASIAA), Taiwan (2015)
35. *The Exoclines Simulation Platform*, NCU-Delta Lecture III, National Central University (NCU), Taiwan (2015)
34. *Exoplanets and the Search for Life Elsewhere*, NCU-Delta Public Lecture, Taiwan (2015)
33. *The Next Great Exoplanet Hunt*, NCU-Delta Lecture II, Delta Electronics, Taiwan (2015)
32. *Exoplanetary Atmospheres in Eras*, NCU-Delta Lecture I, Academia Sinica Institute of Astronomy and Astrophysics (ASIAA), Taiwan (2015)
31. *Exoplanetary Atmospheres in Eras*, NCU-Delta Lecture I, National Central University (NCU), Taiwan (2015)
30. *Analytical Diagnostics for Interpreting Sodium Lines in Exoplanetary Atmospheres*, contributed talk, CHEOPS Science Workshop, Madrid, Spain (2015)
29. *Exoplanet Atmospheres: Theory & Simulation*, invited colloquium, Institut de Planétologie et d'Astrophysique de Grenoble (IPAG), France (2014)
28. *Radiative Transfer in Exoplanet Atmospheres*, exoplanet group seminar (invited), Cambridge University, England (2014)
27. *Exoplanet Atmospheres: Theory & Simulation*, Cavendish astrophysics seminar (invited), Cambridge University, England (2014)
26. *Exoplanet Atmospheres: Theory & Simulation*, invited colloquium, Leiden University, the Netherlands (2014)
25. *Exoplanet Atmospheres: Theory & Simulation*, invited review, Planet Formation and Evolution Workshop, Kiel University, Germany (2014)
24. *The Relevance of Optical Data for Understanding Exoplanetary Atmospheres*, invited review, joint CoRoT-Kepler meeting, Toulouse, France (2014)
23. *Exoplanet Atmospheres: Theory & Simulation*, invited colloquium, Institut d'Astrophysique de Paris (IAP), France (2014)
22. *Exoplanetary Atmospheres*, invited lecture, Annual Member Lecture of the Swiss chapter of Sigma Xi, Bern, Switzerland (2013)
21. *What Can We Learn About Exoplanetary Atmospheres in the Optical?*, contributed talk, PLATO 2.0 Science Workshop, ESTEC, the Netherlands (2013)
20. *Exoplanetary Atmospheres and Climates: Theory and Simulation*, invited seminar, Lund University, Sweden (2013)
19. *The Exoplanets and Exoclines Group at the University of Bern*, invited talk for the Helmholtz Alliance, DLR, Berlin, Germany (2013)

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<sup>3</sup>Swiss Federal Chancellor Walter Thurnherr was in attendance.

18. *What Can We Learn About Exoplanetary Atmospheres in the Optical?*, contributed talk, 1st CHEOPS Science Meeting, Bern, Switzerland (2013)
17. *Exoplanets*, invited talk, Zurich Minds flagship event<sup>4</sup>, Switzerland (2012)
16. *The Study of Climate on Alien Worlds: a Hierarchical Approach to Understanding the Atmospheres of Exoplanets*, invited seminar, Geneva Observatory, Switzerland (2012)
15. *Atmospheric Dynamics of Hot Jupiters and Super Earths*, contributed talk at *Characterizing and Modeling Extrasolar Planetary Atmospheres* conference, Max Planck Institute for Astronomy, Heidelberg, Germany (2012)
14. *The Study of Climate on Alien Worlds: a Hierarchical, Multi-Disciplinary Approach to Understanding the Atmospheres of Exoplanets*, invited talk, Centre for Space and Habitability, University of Bern, Switzerland (2012)
13. *A Hierarchical Approach to Understanding Exoplanetary Atmospheres: from 1D Models to 3D Simulations*, invited colloquium, Anton Pannekoek Institute, University of Amsterdam, the Netherlands (2012)
12. *The Effects of Irradiation on Hot Jovian Atmospheres*, contributed talk at *Exoclimates II* conference, Aspen Center for Physics, U.S.A. (2012)
11. *A Hierarchical Approach to Understanding Exoplanetary Atmospheres: from 1D Models to 3D Simulations*, invited seminar, JILA, University of Colorado, U.S.A. (2012)
10. *A Hierarchical Approach to Understanding Hot Jovian Atmospheres: from 1D Models to 3D Simulations*, invited talk at GCM workshop, Exeter University, England (2011)
9. *A Hierarchical Approach to Understanding Hot Jovian Atmospheres: from 1D Models to 3D Simulations*, invited talk at University College London, England (2011)
8. *Review of Astrophysical Theory of Exoplanetary Atmospheres*, review talk at *Planet-Z: The Atmospheres and Interiors of (Exo)planets*, ETH Zürich, Switzerland (2011)
7. *Joint Constraints on the Atmospheric Chemistry, Dynamics and Temporal Signatures of HD 189733b: Combining Abundance Retrieval with 3D Simulations*, contributed talk at EPSC-DPS Joint Meeting, Nantes, France (2011)
6. *Joint Constraints on the Atmospheric Chemistry, Dynamics and Temporal Signatures of HD 189733b: Combining Abundance Retrieval with 3D Simulations*, contributed talk at *Extreme Solar Systems II* conference, Wyoming, U.S.A. (2011)
5. *A Hierarchical Approach to Understanding Hot Jovian Atmospheres: from 1D Models to 3D Simulations*, invited seminar at Harvard Institute for Theory & Computation, U.S.A. (2011)
4. *A Hierarchical Approach to Modeling Hot Jovian Atmospheres: from 1D Models to 3D Simulations*, invited seminar at Exeter University, England (2011)
3. *The Study of Climate on Alien Worlds: Atmospheric Circulation Simulations of Extrasolar Planets*, contributed talk at EChO workshop, Paris, France (2011)
2. *The Study of Climate on Alien Worlds: Atmospheric Circulation Simulations of Extrasolar Planets*, invited talk at Exeter University, England (2011)
1. *Exoplanetary Astrophysics: Vortices, Atmospheres and Debris Disks*, invited seminar at the Space Telescope Science Institute, U.S.A. (2010)

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<sup>4</sup>Speakers included Gerhard Schroeder and John Gray.

#### 4.2. Others

10. *Balmer-Dominated Shocks: a 3D View from IFU Spectroscopy*, invited talk at the *Explosive Ideas about Massive Stars* conference, AlbaNova University Center, Stockholm (2011)
9. *Planetesimal and Debris Disks: the Late Stages of Planetary Systems*, invited talk at the *Exoplanets for Planetary Scientists* conference, University of Central Florida (2010)
8. *Long-Lived Planetesimal Disks*, invited seminar at Columbia University (2009)
7. *Long-Lived Planetesimal Disks*, invited colloquium at Rutgers University (2009)
6. *Balmer-Dominated Shocks: A Concise Review*, invited review at *Rogersfest: A Festival of Cosmic Explosions*, Caltech (2009)
5. *A Simple Theory of Hydrogen Shocks*, invited colloquium at Stanford University and SLAC (2008)
4. *A Simple Theory of Hydrogen Shocks*, invited talk at the *Supernovae & Gamma-Ray Bursts at Low z in the Era of Reionization* conference, Darjeeling, India (2008)
3. *Basics of Shocks*, invited lecture at the *Supernovae & Gamma-Ray Bursts at Low z in the Era of Reionization* summer school, Darjeeling, India (2008)
2. *Balmer-Dominated Supernova Remnants (and Beyond)*, invited colloquium at Rutgers University (2007)
1. *The Reverse Shock of SNR 1987A*, invited talk at the *Supernova 1987A: 20 Years After (Supernovae & Gamma-Ray Bursters)* winter conference, Aspen Center for Physics (2007)

#### 5. Postdocs & Students

- 2017–present: Chloe Fisher (M.S., Cambridge; University of Bern Ph.D student)<sup>5</sup>
- 2016: Chloe Fisher (M.S., Cambridge; 3-month externship from Cambridge University)
- 2015–present: Frank Wagner (Ph.D, Berlin; PlanetS NCCR postdoc)<sup>6</sup>
- 2015–present: Simon Grimm (Ph.D, Zürich; joint Universities of Bern and Zürich postdoc)<sup>7</sup>
- 2015–present: Maria Oreshenko (M.S., ETH Zürich; University of Bern Ph.D student)
- 2015: Maria Oreshenko (external Masters thesis at University of Bern from ETH Zürich)<sup>8</sup>
- 2014–present: Daniel Kitzmann (Ph.D, Berlin; University of Bern postdoc)<sup>9</sup>
- 2014–present: Shang-Min Tsai (M.S., Taiwan; PlanetS NCCR Ph.D student)
- 2014–2016: Baptiste Lavie (M.S., Paris; PlanetS NCCR Ph.D student)<sup>10</sup>
- 2014–present: Matej Malik (M.S., ETH Zürich; University of Bern Ph.D student)
- 2014–2016: Luc Grosheintz (M.S., ETH Zürich; University of Bern Ph.D student)
- 2013–2017: Joao Mendonca (Ph.D, Oxford; University of Bern postdoc; now Assistant Professor at University of Copenhagen)
- 2012–2015: Jaemin Lee (Ph.D, Oxford; joint Universities of Bern and Zürich postdoc)
- 2012: Pushkar Kopparla (informal undergraduate project student; went to Caltech for Ph.D)
- 2012: Matej Malik (ETH Zürich undergraduate semester project)

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<sup>5</sup>Recipient of University of Bern International 2021 Ph.D Fellowship, which pays 50% salary for 3 years.

<sup>6</sup>Joint with Paul Tackley.

<sup>7</sup>Joint with Ben Moore.

<sup>8</sup>Joint with Hans Martin Schmid.

<sup>9</sup>Joint with Yann Alibert.

<sup>10</sup>Joint with David Ehrenreich.

- 2012: Carsten Heinrich (ETH Zürich undergraduate semester project)
- 2012: Yannick Boetzel (ETH Zürich undergraduate semester project)
- 2012: Constantin Heidegger (ETH Zürich undergraduate semester project)
- 2012: Felix Huber (ETH Zürich undergraduate semester project)
- 2012: Peter Li (ThinkSwiss visiting student)
- 2011: David von Rickenbach (ETH Zürich undergraduate semester project)