Richard H D Townsend — Curriculum Vitae

Professional Preparation

- University of Oxford; B. A. Physics; 1st Class Honors, 1994
- University College London; Ph. D. Astronomy; 1994 – 1997
  - Thesis: 'Non-radial Pulsations in Early-Type Stars' (Advisor: Prof. Ian Howarth)
  - Awarded UCL Harrie Massie prize for best Astronomy/Astrophysics PhD thesis
  - Awarded Royal Astronomical Society Blackwell Prize for best Astronomy/Astrophysics PhD thesis

Appointments

- Associate Professor, Department of Astronomy, University of Wisconsin-Madison; 2014 –
- Assistant Professor, Department of Astronomy, University of Wisconsin-Madison; 2008 – 2014
- Associate Scientist, Bartol Research Institute, University of Delaware; 2006 – 2008
- Research Associate, Bartol Research Institute, University of Delaware; 2004 – 2006
- Limited Term Researcher, Bartol Research Institute, University of Delaware; 2003 – 2004
- Postdoctoral Research Fellow, University College London; 1998 – 2003
- Research Fellow, Reuters Limited, London; 1998
- Physics Teacher, Tuna Secondary Technical School, Ghana; 1997 – 1998

Recent Awards

- NSF Astronomy and Astrophysics Grants Program : *Here be Dragons: Mapping the Instabilities of Massive Stars*; PI R Townsend; \$316,510; 7/1/2017–6/30/202
- NSF Sofrware Infrastructure for Sustained Innovation Program : *SI2-SSI: Modules for Experiments in Stellar Astrophysics*; PI R Townsend; \$683,452; 5/1/2017–4/30/2021
- NSF Software Infrastructure for Sustained Innovation Program : *SI2-SSE: Modules for Experiments in Stellar Astrophysics*; PI R Townsend; \$75,888; 1/1/2014–12/31/2017
- NASA/NSF Theory & Computational Astrophysics Networks Program : *The SPIDER Network: Supernova Progenitor, Internal Dynamics and Evolution Research*; PI R Townsend; \$328,533; 1/1/2014–12/31/2016
- NASA Astrophysics Theory Program : *Massive-Star Magnetospheres: Now in 3D!*; PI R Townsend; \$425,199; 1/1/2012–12/31/2015

Software & Infrastructure Development

- Leading UW-Madison's participation in the *Modules for Experiments in Stellar Astrophysics* (MESA) project, a multi-institutional open source software project. MESA is used a worldwide community of scientists (around 800, as of 2017) to simulate the internal structure and evolution of astrophysical objects from gas-giant planets to white dwarfs to supermassive stars. I serve on MESA's Steering Council, which sets the development roadmap for the software and overseas MESA-related education and community engagement activities; I maintain and further develop the MESA source code; and I curate the Software Development Kit (SDK), which greatly simplifies installing MESA.
- Creating and maintaining the open-source *GYRE* stellar oscillation code.
- Developing and administering the *EZ-Web* on-line stellar evolution portal.

Institutional Service

- Serving on the Organizing Committees of the IAU Working Groups on *Massive Stars* and *Active OB Stars* (vice chair).
- Serving on/chairing time allocation committees for the *Hubble Space Telescope* and *Chandra X-Ray Observatory*.
- Serving/chairing grant review panels for NASA.
- Serving as referee on numerous journal papers.
- Serving on the Scientific Organizing Committees for the *IAU Symposia* 272, 307 and 329 conferences.

Academic Service

- Advising graduate students within the UW Department of Astronomy: Brittin Borland (MSc '12), Nick Hill (PhD '15), Chris Bard (PhD '16), Jacqueline Goldstein (PhD in progress), Aaron Lopez (PhD in progress)
- Serving on and/or chairing the UW Department of Astronomy computing, web, admissions, colloquium, undergraduate, awards and prelims committees.
- Serving as the faculty senator for the UW Department of Astronomy.
- Serving on the UW Advanced Computing Infrastructure committee.

Publications

1. Townsend R. H. D., Goldstein J., Zweibel E., 2017: 'Angular momentum transport by heat-driven g-modes in slowly pulsating B stars', *MNRAS*, in press
2. Owocki S. P., Townsend R. H. D., Quataert E., 2017: 'Super-Eddington stellar winds: unifying radiative-enthalpy vs. flux-driven models', *MNRAS*, in press
3. Petit V., Keszthelyi Z., MacInnis R., Cohen D. H., Townsend R. H. D., Wade G.A., Thomas S. L., Owocki S. P., Puls J., ud-Doula A., 2017: 'Magnetic massive stars as progenitors of 'heavy' stellar-mass black holes', *MNRAS*, **466**, 1052
4. Kurapati Sushma, Chandra Poonam, Wade Gregg, Cohen David H., David-Uraz Alexandre, Gagné Marc, Grunhut Jason, Oksala Mary E., Petit Veronique, Shultz Matt, Sundqvist Jon, Townsend Richard H. D., ud-Doula Asif, 2017: 'A JVLA survey of the high-frequency radio emission of the massive magnetic B- and O-type stars', *MNRAS*, **465**, 2160
5. Owocki S. P., ud-Doula A., Sundqvist J. O., Petit V., Cohen D. H., Townsend R. H. D., 2016: 'An analytic dynamical magnetosphere formalism for X-ray and optical emission from slowly rotating magnetic massive stars', *MNRAS*, **462**, 3830
6. Bard C., Townsend R. H. D., 2016: 'Effect of a magnetic field on massive-star winds - I. Mass-loss and velocity for a dipole field', *MNRAS*, **462**, 3672
7. Moravejji E., Townsend R. H. D., Aerts C., Mathis S., 2016: 'Sub-inertial Gravity Modes in the B8V Star KIC 7760680 Reveal Moderate Core Overshooting and Low Vertical Diffusive Mixing', *ApJ*, **823**, 130
8. Paxton B., Marchant P., Schwab J., Bauer E. B., Bildsten L., Cantiello M., Dessert L., Farmer R., Hu H., Langer N., Townsend R. H. D., Townsley D. M., Timmes F. X., 2015: 'Modules for Experiments in Stellar Astrophysics (MESA): Binaries, Pulsations and Explosions', *ApJS*, **220**, 1
9. Townsend R. H. D., Teitler S. A., 2013: 'GYRE: an open-source stellar oscillation code based on a new Magnus Multiple Shooting scheme', *MNRAS*, **435**, 3406

10. Paxton B., Cantiello M., Arras P., Bildsten L., Brown E. F., Dotter A., Mankovich C., Montgomery M. H., Stello D., Timmes F. X., Townsend R. H. D., 2013: 'Modules for Experiments in Stellar Astrophysics (MESA): Giant Planets, Oscillations, Rotation, and Massive Stars', *ApJS*, **208**, 4
11. Townsend R. H. D., Rivinius Th., Rowe J. F., Matthews J. M., Moffat A. F. J., Bohlender D., Neiner C., Telting J. H., Guenther D. B., Kallinger T., Kuschnig R., Rucinski S. M., Sasselov D., Weiss W. W., 2013: 'MOST Observations of σ Ori E: Challenging the Centrifugal Breakout Narrative', *ApJ*, 769, 33
12. Carciofi A. C., Faes D. M., Townsend R. H. D., Bjorkman J. E. , 2013: 'Polarimetric observations of sigma Orionis E', *ApJL*, **766**, 9
13. Petit V., Owocki S. P., Wade G. A., Cohen D. H., Sundqvist J. O., Gagné M., Maíz Apellániz J., Oksala M. E., Bohlender D. A., Rivinius Th., Henrichs H. F., Alecian E., Townsend R. H. D., ud-Doula A., the MiMeS Collaboration , 2013: A Magnetic Confinement vs. Rotation Classification of Massive-Star Magnetospheres, *MNRAS*, **429**, 398
14. ud-Doula A., Sundqvist J. O., Owocki S. P., Petit V., Townsend R. H. D., 2013: 'First 3D MHD simulation of a massive-star magnetosphere with application to Hα emission from θ^1 Ori C', *MNRAS*, **428**, 2723
15. Rivinius Th., Townsend R. H. D., Kochukhov O., Štefl S., Baade D., Barrera L., Szeifert Th., 2013: 'Basic parameters and properties of the rapidly rotating magnetic B2 Vpn star HR 7355', *MNRAS*, **429**, 177
16. Wade G. A., Grunhut J., Gr afener G., Howarth I. D., Martins F., Petit V., Vink J. S., Bagnulo S., Folsom C. P., Nazé Y., Walborn N. R., Townsend R. H. D., Evans C. J., 2012: 'The spectral variability and magnetic field characteristics of the Of?p star HD 148937', *MNRAS*, **419**, 2459
17. Sundqvist J. O., ud-Doula A., Owocki S. P., Townsend R. H. D., Howarth I. D., Wade G. A., 2012: 'A dynamical magnetosphere model for periodic H emission from the slowly rotating magnetic O star HD 191612' *MNRAS*, **423**, L23
18. Oksala M. E., Wade G. A., Townsend R. H. D., Owocki S. P., Kochukhov O., Neiner C., Alecian E., Grunhut J., 2012: 'Revisiting the Rigidly Rotating Magnetosphere model for σ Ori E – I. Observations and data analysis', *MNRAS*, **419**, 959
19. Grunhut, J. H., Rivinius Th., Wade G. A., Townsend R. H. D., Marcolino W. L. F., Bohlender D. A., Szeifert Th., Petit V., et al., 2012: 'HR 5907: Discovery of the most rapidly rotating magnetic B-type star by the MiMeS Collaboration', *MNRAS*, **419**, 1610
20. Wade G. A., Howarth I. D., Townsend R. H. D., Grunhut J. H., Shultz M., Bouret J.-C., Fullerton A., Marcolino W., et al., 2011: 'Confirmation of the magnetic oblique rotator model for the Of?p star HD 191612', *MNRAS*, **416**, 3160
21. Oksala M. E., Wade G. A., Marcolino W. L. F., Grunhut J., Bohlender D., Manset N., Townsend R. H. D., the MiMeS Collaboration, 2010: 'Discovery of a strong magnetic field in the rapidly rotating B2Vn star HR 7355', *MNRAS*, **405**, L51
22. Rivnius Th., Szeifert Th., Barrera L., Townsend R. H. D., Štefl S., Baade D., 2010: 'Magnetic field detection in the B2Vn star HR 7355', *MNRAS*, **405**, L46
23. Townsend R. H. D., Oksala M. E., Cohen D. H., Owocki S. P., ud-Doula A., 2010: 'Discovery of Rotational Braking in the Magnetic Helium-Strong Star σ Orionis E', *ApJL*, **714**, 318
24. Townsend R. H. D., 2010: 'Fast Calculation of the Lomb-Scargle Periodogram Using Graphics Processing Units', *ApJS*, **191**, 247
25. Harvey-Smith L., Gaensler B. M., Kothes R., Townsend R. H. D., Heald G. H., Ng C.-Y.,

Green A. J., 2010: 'Faraday rotation of the supernova remnant G296.5+10.0: Evidence for a Magnetized Progenitor Wind', *ApJ*, **712**, 1157

26. Grunhut J. H., Wade G. A., Marcolino W. L. F., Petit V., Henrichs H. F., Cohen D. H., Alecian E., Bohlender D., Bouret J.-C., Kochukhov O., Neiner C., St-Louis N., Townsend R. H. D., The MiMeS Collaboration, 2009: 'Discovery of a magnetic field in the O9 sub-giant star HD 57682 by the MiMeS Collaboration', *MNRAS*, **400**, 94
27. Townsend R. H. D., 2009: 'An Exact Integration Scheme for Radiative Cooling in Hydrodynamical Simulations', *ApJS*, **181**, 391
28. ud-Doula A., Owocki S. P., Townsend R. H. D., 2009: 'Dynamical simulations of magnetically channelled line-driven stellar winds - III. Angular momentum loss and rotational spin-down', *MNRAS*, **392**, 1022
29. Townsend R. H. D., 2008: 'Exploring the photometric signatures of magnetospheres around helium-strong stars', *MNRAS*, **389**, 559
30. Skinner S. L., Sokal K. R., Cohen D. H., Gagné M., Owocki S. P., Townsend R. H. D., 2008: 'High-Resolution Chandra X-Ray Imaging and Spectroscopy of the σ Orionis Cluster', *ApJ*, **683**, 796
31. Rivinius Th., Štefl S., Townsend R. H. D., Baade D., 2008: 'The most rapidly rotating He-strong emission line star: HR 7355', *A&A*, **482**, 255
32. ud-Doula A., Owocki S. P., Townsend R. H. D., 2008: 'Dynamical simulations of magnetically channelled line-driven stellar winds - II. The effects of field-aligned rotation', *MNRAS*, **385**, 97
33. Townsend R. H. D., Owocki S. P., ud-Doula A., 2007: 'A Rigid-Field Hydrodynamics approach to modelling the magnetospheres of massive stars', *MNRAS*, **382**, 139
34. ud-Doula A., Townsend R. H. D., Owocki S. P., 2006: 'Centrifugal Breakout of Magnetically Confined Line-driven Stellar Winds', *ApJL*, **640**, 191
35. Townsend R. H. D., MacDonald J., 2006: 'Excitation of g modes in Wolf-Rayet stars by a deep opacity bump', *MNRAS*, **368**, 57
36. Gagné M., Oksala M. E., Cohen D. H., Tonnesen S. K., ud-Doula A., Owocki S. P., Townsend R. H. D., MacFarlane J. J., 2005: 'Chandra HETGS Multiphase Spectroscopy of the Young Magnetic O Star θ^1 Orionis C', *ApJ*, **628**, 986
37. Townsend R. H. D., 2005: 'Kappa-mechanism excitation of retrograde mixed modes in rotating B-type stars', *MNRAS*, **364**, 573
38. Townsend R. H. D., Owocki S. P., Groote D., 2005: 'The Rigidly Rotating Magnetosphere of σ Orionis E', *ApJL*, **630**, 81
39. Townsend R. H. D., 2005: 'Influence of the Coriolis force on the instability of slowly pulsating B stars', *MNRAS*, **360**, 465
40. Townsend R. H. D., Owocki S. P., 2005: 'A rigidly rotating magnetosphere model for circumstellar emission from magnetic OB stars', *MNRAS*, **357**, 251
41. Townsend R. H. D., Owocki S. P., Howarth I. D., 2004: 'Be-star rotation: how close to critical?', *MNRAS*, **350**, 189
42. Townsend R. H. D., 2003: 'Surface modelling of non-radial pulsators: alternative formalisms within the linear approximation', *MNRAS*, **343**, 863
43. Townsend R. H. D., 2003: 'A semi-analytical formula for the light variations due to low-frequency g modes in rotating stars', *MNRAS*, **343**, 125
44. Townsend R. H. D., 2003: 'Asymptotic expressions for the angular dependence of low-frequency pulsation modes in rotating stars', *MNRAS*, **340**, 1020

45. Townsend R. H. D., 2002: 'Photometric modelling of slowly pulsating B stars', *MNRAS*, **330**, 855
46. Townsend R. H. D., Ivison R. J., Smail I., Blain A. W., Frayer D. T., 2001: 'Gigamasers: the key to the dust-obscured star formation history of the Universe?', *MNRAS*, **328**, 17
47. Townsend R. H. D., 2000: 'Surface trapping and leakage of low-frequency g modes in rotating early-type stars - II. Global analysis', *MNRAS*, **319**, 289
48. Townsend R. H. D., 2000: 'Surface trapping and leakage of low-frequency g modes in rotating early-type stars - I. Qualitative analysis', *MNRAS*, **318**, 1
49. Townsend R. H. D., 1997: 'Spectroscopic modelling of non-radial pulsation in rotating early-type stars', *MNRAS*, **284**, 839

Recent Presentations

1. 'Yin-Yang Seismology of Slowly Pulsating B Stars', invited colloquium at University of Chicago, Chicago, IL, Jan 2017

2. 'Yin-Yang Seismology of Slowly Pulsating B Stars', invited colloquium at Center for Computational Astrophysics, New York, NY, Oct 2016

3. 'Yin-Yang Seismology of Slowly Pulsating B Stars', invited colloquium at Canadian Royal Military College, Kingston, ON, Oct 2016

4. 'Yin-Yang Seismology of Slowly Pulsating B Stars', invited colloquium at Georgia State University, Atlanta, GA, Canada, Oct 2016

5. 'MESA & GYRE: Stellar Astrophysics for the People', invited colloquium at Aarhus University, Denmark, Dec 2015

6. 'Brite's Role in Stellar Physics', invited review talk at *Science with BRITE-Constellation*, Gdansk, Poland, Sep 2015

7. 'Ghost Hunting at Five Hundred Parsecs: The Glowing Magnetospheres of Massive, Luminous Stars', invited colloquium at Space Telescope Science Institute, Baltimore, MD, Nov 2014

8. 'Extrapolation at 500 Parsecs: The Magnetospheres of OB Stars', invited review talk at *Magnetism and Variability in O stars*, Amsterdam, The Netherlands, Sep 2014

9. 'Ghostly Impostors: The Glowing Magnetospheres of Massive Stars', invited seminar at Iowa State University, Ames, IA, Nov 2013

10. 'The Pulsation-Rotation Interaction: Greatest Hits and the B-side', invited review talk at *IAU Symposium 301: Precision Asteroseismology*, Wroclaw, Poland, Aug 2013

11. 'GYRE: Yet another oscillation code, why we need it and how it works', invited talk at *ERC/PROSPERITY/BAG Meeting 2012: Asteroseismology in Action: From Young to Old Stars*, Leuven, Belgium, Dec 2012

12. 'Asteroseismology', invited seminars (2) at *The MESA Summer School*, University of California-Santa Barbara, CA, Aug 2012

13. 'Massive-Star Magnetospheres: The Interplay between Outflows, Rotation and Magnetic Fields ', invited review talk at *Circumstellar Dynamics at High Resolution*, Foz do Iguaçu, Brazil, Feb/Mar 2012

14. 'Magnetic Braking of Massive Stars: Theory and Observations', invited talk at *52nd American Physical Society-Division of Plasma Physics Annual Meeting*, Chicago, IL, Nov 2011