Jonathan Henshaw

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Employment

Max Planck Institute for Astronomy, Heidelberg, Germany **07/2017-Present**
Postdoctoral Research Fellow

As a fellow in the Planet and Star Formation group at the MPIA, my research focuses on understanding star formation in different galactic environments, with particular attention on understanding the dynamics of the molecular interstellar medium.

Liverpool John Moores University, Liverpool, UK **2014-2017**
Postdoctoral Research Assistant

I worked with Prof. Steve Longmore studying the orbital dynamics of molecular gas within the Central Molecular Zone of the Milky Way and how this relates to star formation.

Education

Ph. D.	**University of Leeds** "Kinematics and Physical Structure of a Highly Filamentary IRDC" *Supervisor: Prof. Paola Caselli*	**2010-2014**
MPhys & BSc	**University of Leeds** Physics with Astrophysics, First Class (1:1), Hons.	**2005-2009**

Research Interests

The interstellar medium (ISM), ISM structure and dynamics, star and cluster formation, environmental studies of star formation, molecular cloud formation, (sub-)millimetre astronomy, software development, statistical analysis

Professional Summary

- 24 refereed publications, 7 as first author. Total citations = 464, H-index = 13
- 21 oral presentations (inc. seminars, colloquia, and conferences), 3 poster presentations
- Referee (MNRAS, The Astrophysical Journal, Astronomy & Astrophysics)
- PDRA management board representative (LJMU, 2017)
- PDRA IoP Juno representative (LJMU, 2017)
- Journal club coordinator (LJMU, 2014-2017)
- Journal club coordinator (University of Leeds, 2012-2013)

Observing Summary

- PI project time: ALMA+ACA (8 hrs), IRAM 30m (68.1 hrs), NOEMA/PdBI (62 hrs)
- Co-I project time: ALMA+ACA (228 hrs), ESO-ARO (800 hrs), IRAM 30m (163 hrs), VLA (120 hrs)
- Observational experience: IRAM 30m telescope (~3 weeks)
- Data reduction: CASA (advanced), GILDAS (advanced)
- Workshops: European Radio Interferometry School (2015), ESO

Computing Summary

- Languages: Python (advanced), IDL (advanced), C++ (basic), HTML (basic)
- Software design and development: https://github.com/jdhenshaw
- Lead developer for:
  i. SCOUSE: Semi-Automated multi-COmponent Universal Spectral line-fitting Engine (IDL, Python)
  ii. ACORNS: Agglomerative Clustering for ORganising Nested Structures (Python)

Fellowships & Awards

2017	ESO Fellowship (Declined), European Southern Observatory, Germany
2014	STFC Studentship Enhancement Programme (Declined), University of Leeds, UK

Student Supervision (advisory role: Technical assistance, meetings, co-authorship)

2020	**Manuel Reiner (MPIA)** Riener et al, 2019, MNRAS, sub.	Ph. D
2019	**Daniel Callanan (LJMU)**	Ph. D
2019	**Hannah Dalgleish (LJMU)** Dalgleish et al., 2018, MNRAS, 478, 3530	Ph. D
2018	**Ashley Barnes (Leeds, LJMU, MPE)** Thesis: “A Comparison of star formation within the Galactic centre and Galactic disc" *Barnes et al., 2018, MNRAS, 475, 5268* *Barnes et al., 2017, MNRAS, 469, 2263* *Barnes et al., 2016, MNRAS, 458, 1990*	MPhys & Ph. D.
2016	**Katharine Beaumont (LJMU)**	MPhys
2016	**Mark Williams (LJMU)**	MPhys
2015	**Bryony Holloway (LJMU)**	MPhys

Teaching

2012-14	Astronomical CCD imaging, undergraduate physics lab, University of Leeds
2010-14	Gamma-ray spectroscopy, undergraduate physics lab, University of Leeds

References

- **Prof. Dr. Thomas Henning (email: henning@mpia.de)**
  Director of Max Planck Institute for Astronomy, Heidelberg, Germany
- **Prof. Dr. Paola Caselli (email: caselli@mpe.mpg.de)**
  Director of Max Planck Institute for Extraterrestrial Physics, Munich, Germany
- **Prof. Steve Longmore (email: s.n.longmore@ljmu.ac.uk)**
  Reader in Astrophysics, Astrophysics Research Institute, LJMU, UK

Observing time (Last 3 years)

2018	**ALMA - Cycle 6** From filaments to cores: Dynamics in infrared dark clouds	**Co-I**	**9.1 Hrs (+108.6 ACA)**
2018	**ESO-ARO - Large Program** SHREC: SHock interactions between supernova REmants and molecular Clouds	**Co-I**	**800.0 Hrs**
2018	**IRAM 30m - Summer 2018** Investigating the kinematic imprints of an interstellar collision	**PI**	**29.3 Hrs**
2018	**IRAM 30m - Summer 2018** Widespread SiO Emission in the Filamentary Infrared Dark Cloud G034.77-00.55	**Co-I**	**56.9 Hrs**
2018	**NOEMA - Summer 2018** Investigating the kinematic imprints of an interstellar collision	**PI**	**42.0 Hrs**
2018	**VLA - Winter 2018** Is Active Star Formation Emerging in the Central Molecular Zone?	**Co-I**	**30.8 Hrs**
2017	**ALMA - Cycle 5** Uncovering the early stages of massive star formation in the extreme environment of the Central Molecular Zone	**Co-I**	**6.7 Hrs**
2017	**ALMA - Cycle 5** Out of the Frying Pan, into the Fire: the Onset of Star formation in Gas entering the Central Molecular Zone	**Co-I**	**5.3 Hrs (+16.3 ACA)**
2017	**ALMA - Cycle 5** Unveiling the disk around a young high-mass proto-star in the extreme Galactic centre cloud G0.478-0.005	**Co-I**	**10.8 Hrs**
2017	**IRAM 30m - Winter 2017** Widespread SiO Emission in IRDCs: Molecular Cloud Filaments Forming via Cloud-Cloud Collision	**Co-I**	**43.7 Hrs**
2017	**VLA - Summer 2017** Orbital structure of the Central Molecular Zone under scrutiny	**Co-I**	**6.5 Hrs**
2017	**VLA - Summer 2017** The dynamics of ionised gas within the Galactic Centre	**Co-I**	**15.0 Hrs**
2016	**ALMA - Cycle 4** Widespread SiO in IRDCs: Cloud-Cloud Collision Formation of Molecular Cloud Filaments?	**Co-I**	**4.8 Hrs (+24.1 ACA)**
2016	**VLA - Winter 2016** Cloud-scale Kinematics of Infrared Dark Clouds	**Co-I**	**4.4 Hrs**
2016	**VLA - Summer 2016** 3D motions of gas clouds in the Central Molecular Zone	**Co-I**	**63.0 Hrs**

Observing time leading to recent publications

2014	**IRAM 30m - Summer 2014** Flow-driven formation of molecular cloud filaments: A kinematic study of the dense gas in IRDCs *Barnes, +Henshaw et al. (2018)*	**PI**	**38.8 Hrs**
2013	**ALMA - Cycle 2** Extreme Star Formation "The Movie": the early assembly of monster stars and clusters caught in action *Barnes, +Henshaw et al. (2019.)*	**Co-I**	**8.4 Hrs (+33.8 ACA)**
2013	**ALMA - Cycle 2** Dissecting filaments with ALMA: Unveiling the dynamic properties of dense cores within a massive IRDC *Henshaw et al. (2017)*	**PI**	**1.6 Hrs (6.4 ACA)**
2012	**IRAM 30m - Winter 2012** Flow-driven formation of Molecular Cloud Filaments: Widespread SiO in IRDCs *Cosentino, +Henshaw et al. (2018)*	**Co-I**	**62.2 Hrs**
2011	**PdBI - Summer 2011** Dense gas structure and kinematics in a quiescent Infrared Dark Cloud *Henshaw et al. (2014), Henshaw et al. (2016b)*	**PI**	**20.0 Hrs**

Invited Talks & Seminars

2019	**“Star formation in the Galactic Centre”** New Horizons in Galactic Center Astronomy & Beyond, Yokohama, Japan	**Invited Talk**
2019	**“The anatomy of the Milky Way’s Central Molecular Zone”** Max Planck Institute for Nuclear Physics, Heidelberg, Germany	**Invited Seminar**
2018	**“Towards understanding cloud and star formation in the CMZ”** Hengstberger Symposium: The multi-scale physics of star formation and feedback during galaxy formation, Heidelberg, Germany	**Invited Talk**
2017	**“Star formation in extreme environments: Gas dynamics of the CMZ”** Arcetri Astrophysical Observatory (INAF), Florence, Italy	**Invited Seminar**
2017	**“The Kinematics of the Star-Forming ISM”** Max Planck Institute for Astronomy, Heidelberg, Germany	**Invited Seminar**
2016	**“The Kinematics of the Star-Forming ISM”** Harvard-Smithsonian Centre for Astrophysics, Cambridge, US	**Invited Seminar**
2015	**"The complex kinematics of (massive) star forming regions”** Centre for Astrochemical Research, MPE, Munich, Germany	**Invited Seminar**
2014	**"The complex kinematics of (massive) star forming regions”** St. Andrews University, UK	**Invited Seminar**

Selected Scientific Talks (Last 5 years)

2019 **"Ubiquitous velocity oscillations throughout the ISM in the MW and Nearby Galaxies"**
The ISM and SF from cores to kpc scales, Helsinki, Finland

2018 **"Seeding the Galactic Centre gas stream"**
Early Phases Of Star formation, Ringberg Castle, Germany

2018 **"Seeding the Galactic Centre gas stream"**
European Week of Astronomy and Space Science, Liverpool, UK

2016 **"Seeding the Galactic Centre gas stream"**
Star formation 2016, Exeter, UK

2016 **"Molecular gas kinematics of the CMZ"**
IAU symposium 322, Palm Cove, Australia

2015 **"Gas kinematics in massive and dense molecular clouds"**
The kinematics of star formation, RAS, UK

2015 **"The complex kinematics of a highly filamentary infrared dark cloud"**
Filaments 2015, USM, Munich, Germany

2014 **"The dynamical properties of filaments in the IRDC G035.39-00.33"**
Mass assembly from clouds to clusters, Sexten, Italy

Additional Conference Contributions & Presentations

2018 **"The Brick is not a *brick*"** **Poster**
Heidelberg-Harvard workshop on the physics of star formation

2018 **"Galactic plane surveys, Molecular clouds, filaments"** **Discussion Leader**
Tracing the Flow: galactic environments and the formation of massive stars, Windermere, UK

2013 **"Complex kinematics in a filamentary IRDC"** **Poster**
Protostars & Planets VI, Heidelberg, Germany

2011 **"Kinematics in a filamentary IRDC"** **Poster**
The Molecular Universe, IAU symposium 280, Toledo, Spain

Conference Organisation

2018 **Heidelberg-Harvard workshop on the physics of star formation** **LOC**
Heidelberg, Germany

2017 **Northern Star Formation Meeting** **Organiser**
LJMU, Liverpool, UK

Publication List:
24 refereed publications inc. 7 first author; Total Citations = 464; H-index = 13
ADS Library URL: ui.adsabs.harvard.edu/#/public-libraries/R1PKR1pyQFaap-dt8wSDwQ

First Author:

7. *"The Brick" is not a brick: A comprehensive study of the structure and dynamics of Central Molecular Zone cloud G0.253+0.016*, **J. D. Henshaw** et al., 2019, MNRAS, 485, 2457
6. *Unveiling the early-stage anatomy of a protocluster hub with ALMA*, **J. D. Henshaw**, I. Jiménez-Serra, S. N. Longmore, P. Caselli, J. E. Pineda, A. Avison, A. T. Barnes, J. C. Tan, F. Fontani, 2017, MNRAS, 464L, 31
5. *Seeding the Galactic Centre gas stream: Gravitational instabilities set the initial conditions for the formation of protocluster clouds*, **J. D. Henshaw**, S. N. Longmore, J. M. D. Kruijssen, 2016, MNRAS, 463L, 122
4. *Investigating the structure and fragmentation of a highly filamentary IRDC*, **J. D. Henshaw**, P. Caselli, F. Fontani, I. Jiménez-Serra, J. C. Tan, S. N. Longmore, J. E. Pineda, R. J. Parker, A. T. Barnes, 2016, MNRAS, 463, 146
3. *Molecular gas kinematics within the inner 250 pc of the Milky Way*, **J. D. Henshaw** et al., 2016, MNRAS, 457, 2675
2. *The dynamical properties of dense filaments in the infrared dark cloud G035.39-00.33*, **J. D. Henshaw**, P. Caselli, F. Fontani, I. Jiménez-Serra, J. C. Tan, 2014, MNRAS, 440, 2860
1. *Complex, quiescent kinematics in a highly filamentary infrared dark cloud*, **J. D. Henshaw**, P. Caselli, F. Fontani, I. Jiménez-Serra, J. C. Tan, A. K. Hernandez, 2013, MNRAS, 417, 2950

Co-Author:

18. GaussPy+: A fully automated Gaussian decomposition package for emission line spectra, M. Riener, J. Kainulainen, **J. D. Henshaw**, J. H. Orkisz, C. E. Murray, H. Beuther, MNRAS, sub.

17. Young massive cluster formation in the Galactic Centre is driven by global gravitational collapse of high-mass molecular clouds, A. T. Barnes, S. N. Longmore, A. Avison, Y. Contreras, A. Ginsburg, **J. D. Henshaw**, J. M. Rathborne, D. L. Walker, J. Alves, J. Bally, C. D. Battersby, M. T. Beltran, H. Beuther, G. Garay, L. Gomez, J. M. Jackson, J. Kainulainen, J. M. D. Kruijssen, X. Lu, E. A. C. Mills, J. Ott, T. Peters, MNRAS, 486, 283

16. The Dynamical evolution of molecular clouds near the Galactic Centre - II. Spatial structure and kinematics of simulated clouds, J. M. D. Kruijssen, J. E. Dale, S. N. Longmore, D. L. Walker, **J. D. Henshaw**, S. M. R. Jeffreson, M. A. Petkova, A. Ginsburg, A. T. Barnes, C. D. Battersby, K. Immer, J. M. Jackson, E. R. Keto, N. Krieger, E. A. C. Mills, A. Sanchez-Monge, A. Schmiedeke, S. T. Suri, Q. Zhang, 2019, MNRAS, 484, 5734

15. Multicomponent kinematics in a massive filamentary infrared dark cloud, V. Sokolov, K. Wang, P. Caselli, J. E. Pineda, **J. D. Henshaw**, A. T. Barnes, J. C. Tan, F. Fontani, I. Jiménez-Serra, 2019, ApJ, 872, 30

14. Ionized gas kinematics in bipolar H II regions, H. S. Dalgleish, S. N. Longmore, T. Peters, **J. D. Henshaw**, J. L. Veitch-Michaelis, J. S. Urquhart, 2018, MNRAS, 478, 3530

13. Similar complex kinematics within two massive, filamentary infrared dark clouds, A. T. Barnes, **J. D. Henshaw**, P. Caselli, I. Jiménez-Serra, J. C. Tan, F. Fontani, A. Pon, S. Ragan, 2018, MNRAS, 475, 5268

12. *Widespread SiO and CH3OH Emission in Filamentary Infrared Dark Clouds*, G. Consetino, I. Jiménez-Serra, **J. D. Henshaw**, P. Caselli, S. Viti, A. T. Barnes, F. Fontani, J. C. Tan, A. Pon, 2018, MNRAS, 474, 3760
11. Subsonic islands within a high-mass star-forming infrared dark cloud, V. Sokolov, K. Wang, J. E. Pineda, P. Caselli, **J. D. Henshaw**, A. T. Barnes, J. C. Tan, F. Fontani, I. Jiménez-Serra, Q. Zhang, 2018, A&A, 611, L3

10. *Star formation in a high-pressure environment: an SMA view of the Galactic Centre dust ridge*, D. L. Walker, S. N. Longmore, C. Battersby, E. Keto, J. M. D. Kruijssen, A. Ginsburg, X. Lu, **J. D. Henshaw**, J. Kauffmann, T. Pillai, E. A. C. Mills, A. J. Walsh, J. Bally, L. C. Ho, K. Immer, K. G. Johnston, 2018, MNRAS, 474, 2373

9. *Distributed star formation throughout the Galactic Centre cloud Sgr B2*, A. Ginsburg, J. Bally, A. T. Barnes, N. Bastian, C. Battersby, H. Beuther, C. Brogan, Y. Contreras, J. Corby, J. Darling, C. DePree, R. Galvan-Madrid, G. Garay, **J. D. Henshaw**, T. Hunter, J. M. D. Kruijssen, S. N. Longmore, X. Lu, F. Meng, E. A. C. Mills, J. Ott, J. E. Pineda, A. Sanchez-Monge, P. Schilke, A. Schmiedeke, D. L. Walker, D. Wilner, 2018, ApJ, 853, 171

8. *The survey of water and ammonia in the Galactic Centre (SWAG): Molecular cloud evolution in the Central Molecular Zone*, N. Krieger, J. Ott, H. Beuther, F. Walter, J. M. D. Kruijssen, D. S. Meier, E. A. C. Mills, Y. Contreras, P. Edwards, A. Ginsburg, C. Henkel, **J. D. Henshaw**, J. Jackson, J. Kauffmann, S. N. Longmore, S. Martin, M. R. Morris, T. Pillai, M. Rickert, E. Rosolowsky, H. Shinnaga, A. Walsh, F. Yusef-Zadeh, Q. Zhang, 2017, ApJ, 850, 77

7. *Temperature structure and kinematics of the IRDC G035.39-00.33*, V. Sokolov, K. Wang, J. E. Pineda, P. Caselli, **J. D. Henshaw**, J. C. Tan, F. Fontani, I. Jiménez-Serra, W. Lim, 2017, 606, 133

6. *H2O Southern Galactic Plane Survey (HOPS): Paper III - Properties of Dense Molecular Gas across the Inner Milky Way,* S. N. Longmore, A. J. Walsh, C. R. Purcell, D. J. Burke, **J. D. Henshaw**, D. Walker, J. Urquhart, A. T. Barnes, M. Whiting, M. G. Burton, S. L. Breen, T. Britton, K. J. Brooks, M. R. Cunningham, J. A. Green, L. Harvey-Smith, L. Hindson, M. G. Hoare, B. Indermuehle, P. A. Jones, N. Lo, V. Lowe, T. J. T. Moore, M. A. Thompson, M. A. Voronkov, 2017, MNRAS, 470, 1462

5. *Star Formation Rates and Efficiencies in the Galactic Centre*, A. T. Barnes, S. N. Longmore, C. Battersby, J. Bally, **J. D. Henshaw**, D. Walker, 2017, MNRAS, 469, 2263

4. *^{15}N Fractionation in Infrared Dark Cloud Cores,* S. Zeng, I. Jiménez-Serra, S. Viti, A. T. Barnes, **J. D. Henshaw,** P. Caselli, F. Fontani, P. Hily-Blant, 2017, A&A, 603, 22

3. *Widespread deuteration across the IRDC G035.39-00.33, A. T. Barnes, S. Kong, J. C. Tan, **J. D. Henshaw**, P. Caselli, I. Jiménez-Serra, F. Fontani, 2016, MNRAS, 458, 1990*

2. *Constraining globular cluster formation through studies of young massive clusters - V. ALMA observations of clusters in the Antennae,* I. Cabrera-Ziri, N. Bastian, S. N. Longmore, C. Brogan, K. Hollyhead, S. S. Larsen, B. Whitmore, K. Johnson, R. Chandar, **J. D. Henshaw**, B. Davies, J. E. Hibbard, 2015, MNRAS, 448, 2224

1. *Gas kinematics and excitation in the filamentary IRDC G035.39-00.33*, I. Jiménez-Serra, P. Caselli, F. Fontani, J. C. Tan, **J. D. Henshaw**, J. Kainulainen, A. K. Hernandez, 2014, MNRAS, 439, 1996

Conference Contributions:

5. *Molecular gas kinematics of the CMZ: Great oaks from little acorns grow*, **J. D. Henshaw**, 2016, IAU Symposium 322, The Multi-Messenger Astrophysics of the Galactic Centre, Eds. R. Crocker, S. Longmore & G. Bicknell, Cambridge University Press, 2016, https://arxiv.org/abs/1609.09749

4. *A brief update on the CMZoom survey*, C. Battersby, E. Keto, Q. Zhang, S. N. Longmore, J. M. D. Kruijssen, T. Pillai, J. Kauffmann, D. Walker, X. Lu, A. Ginsburg, J. Bally, E. A. C. Mills, **J. D. Henshaw**, K. Immer, N. Patel, V. Tolls, A. Walsh, K. Johnston, L. C. Ho, IAU Symposium 322, The Multi-Messenger Astrophysics of the Galactic Centre, Eds. R. Crocker, S. Longmore & G. Bicknell, Cambridge University Press, 2016, https://arxiv.org/abs/1610.05805

3. *Using young massive clusters to understand star formation and feedback in high-redshift-like environments*, S. N. Longmore, A. T. Barnes, J. Bally, J. M. D. Kruijssen, J. Dale, **J. D. Henshaw**, D. Walker, J. Rathborne, L. Testi, J. Ott, A. Ginsberg, Conditions and Impact of Star Formation, Eds. R. Simon, R. Schaaf and J. Stutzki, EAS Publications Series, 2016, https://arxiv.org/abs/1601.02654

2. *Complex kinematics in a highly filamentary IRDC*, **J. D. Henshaw**, P. Caselli, I. Jiménez-Serra, F. Fontani, J. C. Tan, 2014, Protostars and Planets VI, Heidelberg, July 15-20, 2013, Poster 1S021
1. *CO gas kinematics and excitation in a filamentary IRDC: Filament-filament interaction and accretion processes*, I. Jiménez-Serra, P. Caselli, F. Fontani, J. C. Tan, **J. D. Henshaw**, J. Kainulainen, A. K. Hernandez, Protostars and Planets VI, Heidelberg, July 15-20, 2013, Poster 1S034

Media Coverage:

4. *The Milky Way's Central Molecular Zone*, 2016, phys.org
3. *Unravelling the Milky Way's Central Molecular Zone,* 2016, Astronomy Now
2. *Astronomers Take A Closer Look at the Milky Way's Central Molecular Zone*, 2016, *scitechdaily.com*
1. *The Milky Way's Central Molecular Zone*, Harvard Center for Astrophysics press release, 2016, https://www.cfa.harvard.edu/news/su201609

Papers in preparation (anticipated publication within 6 months):

2. *Velocity structure in giant molecular filaments*, S. E. Ragan & **J. D. Henshaw,** 2019, in preparation
1. *What's Sculpting the Brick? II*, **J. D. Henshaw**, 2019, in preparation