Michael S. Petersen

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Research

Design, implement, execute, and analyse precision numerical models to understand dynamical evolution in disk galaxies and their halo environs.

Position

Postdoctoral Research Associate, Institute for Astronomy. 2019-

Education

Doctor of Philosophy, Astronomy 2019
University of Massachusetts at Amherst, Amherst, MA, USA
The non-linear dynamics of barred galaxy evolution in ΛCDM
Advisors: Martin D. Weinberg, Neal Katz

Bachelor of Arts, Astronomy & Physics, Music 2010
Colgate University, Hamilton, NY, USA

Collaborations

Basis-function expansion (Beefy) Collaboration
'Architect' status in a Center for Computational Astrophysics (NYC)-led collaboration (PIs: Kathryn Johnston [Columbia University, New York], Martin Weinberg [University of Massachusetts, Amherst]). The group is working to develop a holistic approach to galaxy evolution using basis function expansions. I am directly responsible for coordinating software development to assist collaboration science.

Surrey-Edinburgh Streams Collaboration
Responsible for building a revolutionary numerical framework to simulate stellar streams in the presence of an evolving potential. Development is directly assisting a PhD project in Surrey.

SEGAL Collaboration
Assisting analysis of barred galaxies in the New Horizon simulation within the SEGAL collaboration (PI: Christophe Pichon [Institut Astrophysique de Paris]). The collaboration is developing a new kinetic theory-based picture of galactic dynamics. I am responsible for supplying a novel kinematic method to detect barred galaxies with unprecedented sensitivity.

Astrophysics Institute Potsdam Collaboration

Teaching & Advising

University of Edinburgh MPhys Research Advisor 2020-
Designed and advised a masters project at the University of Edinburgh.

Columbia University (NYC) Post-Baccalaureate Program Research Advisor 2020-

Assisted advising, providing project guidance and numerical training, to a post-baccalaureate student at Columbia University, New York.

University of Edinburgh Research Advisor Summer 2020
Designed, sought funding for, and advised two summer research projects for advanced undergraduate students at the University of Edinburgh.

University of Edinburgh Senior Honours Research Advisor 2019-
Designed and advised seven research projects for undergraduate students at the University of Edinburgh over four semesters.

Five College Astronomy Teaching Assistant 2014-2018
Assisted teaching of Observational Techniques I/II, a two-semester advanced undergraduate observing course including a trip to a professional telescope to obtain data. Designed significant materials still in use for teaching. University of Massachusetts Distinguished Teaching Award finalist, 2018.

Service

Equality, Diversity and Inclusion Team Organiser 2020-
Initiated a team to study issues of equality, diversity and inclusion at the Intitute for Astronomy.

ROE Seminar Organiser 2019-
Responsible for selection of speakers and organising delivery of talks for the Royal Observatory. Includes remote organisation and hosting during work-from-home period.

Local Universe Reading Group Organiser 2019-
Responsible for programming and hosting a roughly dozen-person reading group covering multiple research teams at the ROE. Includes remote organisation and hosting during work-from-home period.

Recent Invited Talks

Institute of Astronomy (Cambridge) Dynamics Group May 2020
Bar models beyond analytic formulae

AIP (Potsdam) Local Universe Group January 2020
Bespoke N-body experiments in barred galaxy dynamics

University of St. Andrews January 2020
Bespoke N-body experiments in barred galaxy dynamics

Recent Outreach Talks

Dundee Astronomical Society October 2020
How do astronomers model gravity?

Royal Observatory Open Days September 2020
Spaceship Earth: The amazing travels of our home through the cosmos

Highlands Astronomical Society August 2020
Why Can't We Find Dark Matter?

University of the Third Age Astronomy Group January 2020
Why Can't We Find Dark Matter?

Selected Observational Experience

NASA IRTF, Co-I (2018B, 2019B, 2020B), 12 nights
SpeX+MORIS Star Spot Monitoring of K2 Selected T Tauri Stars in Taurus-Auriga
iSHELL Accretion and Gas Dynamics in Transition Disk-bearing Young Stars Across the Substellar Boundary

KPNO 0.9m, PI (2016-2017), 5 nights; Co-I (2014-2018), 30 nights
Deep Imaging of Nearby Low Surface Brightness Disks
Ionization States of Green Pea Galaxies

Large Millimeter Telescope, PI (Early Science 2,3,4 2014-2016), 60 hours
Circumstellar Disk Masses in IC 348

Professional Links

Research Webpage `https://michael-petersen.github.io`

Github Code Repository `https://github.com/michael-petersen`

References

Jorge Peñarrubia
Postdoctoral Research Associate supervisor.

Martin D. Weinberg
Co-dissertation advisor.

Neal Katz
Co-dissertation advisor.

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Publications

Refereed Publications

5. **Petersen, M. S.**, Weinberg, M. D., and Katz, N. *Using commensurabilities and orbit structure to understand barred galaxy evolution*, arXiv e-prints, MNRAS accepted.
4. **Petersen, M. S.** & Peñarrubia, J. *Reflex motion in the Milky Way stellar halo resulting from the Large Magellanic Cloud infall*, 2020, MNRASL, 494:11.
3. **Petersen, M. S.**, Weinberg, M. D., and Katz, N. *Using torque to understand barred galaxy models*, 2019, MNRAS, 490:3616.
2. **Petersen, M. S.**, Katz, N. , & Weinberg, M.D. *The Dynamical Response of Dark Matter to Galaxy Evolution Affects Direct-Detection Experiments*, Phys Rev D, 2016. Figure 4 was featured as part of the journal's 'Kaleidoscope'.
1. **Petersen, M. S.**, Weinberg, M. D., and Katz, N. *Dark matter trapping by stellar bars: the shadow bar* 2016 MNRAS, 463:1952–1967.

Publications In Review

4. **Petersen, M. S.** & Peñarrubia, J. *Detection of the Milky Way reflex motion induced by the Large Magellanic Cloud infall*, 2020, Nature Astronomy accepted.
3. **Petersen, M. S.**, Weinberg, M. D., and Katz, N. EXP*: N-body integration using basis function expansions*, arXiv e-prints, MNRAS accepted.
2. Weinberg, M. D. & **Petersen, M. S.** *Using Multichannel Singular Spectrum Analysis to Study Galaxy Dynamics*, arXiv e-prints.
1. **Petersen, M. S.**, Weinberg, M. D., and Katz, N. *Using harmonic decomposition to understand barred galaxy evolution*, arXiv e-prints.