

HELMER HERMAN KOPPELMAN

CONTACT

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ABOUT ME

I am a fast learner with a broad interest ranging from science and finance to politics and arts. I derive my world-leading research in astrophysics from combining theory with simulations and big data (data sets with over a billion stars). I have an affinity for **statistics**, **data science**, and **machine learning**. Finally, I am flexible and always looking to improve myself.

EDUCATION

University of Groningen

PhD Astronomy (**cum laude**) 2016 - 2020

MSc Astronomy (**cum laude**) 2014 - 2016

BSc Astronomy 2011 - 2014

LIBRARIES & TOOLS

Data preprocessing & analysis (pandas, vaex, jupyter)	●●●●
Scientific computing (numpy, scipy, matplotlib, sklearn)	●●●●
Dimensionality reduction (t-SNE, UMAP, PCA)	●●●●○
Statistical modeling (Regression, clustering, classification)	●●●●○
Basic experience with NN (Keras, PyTorch, Jax, TensorFlow)	●○○○○
MCMC simulations	●●●●○
Bayesian analysis	●●●○○
Modifying & optimizing code	●●●●○

LANGUAGES

Spoken

Dutch (native):	●●●●●
English:	●●●●●

Programming

Python/UNIX:	●●●●●
Fortran/git/SQL:	●●●●○
C/C++/HTML/Matlab:	●○○○○

Awards & Prizes

Wierenga-Rengerink PhD Prize nominee

As best thesis of the Faculty of Science and Engineering, my thesis was nominated for the prize of best thesis of the university in 2020. It was chosen out over 200 theses.

PUBLICATIONS

	Total	August 2021	First Author
Submitted	16	9	
Refereed	14	8	
Citations	942	227	

See also [Google Scholar](https://scholar.google.com/citations?user=HJLjwQAAAAJ&hl=en)

PROFESSIONAL EXPERIENCE

Postdoctoral Researcher

2020 -

Institute for Advanced Study

Through statistical analysis of large astronomical data sets and interpretation of observations with theory, I study the dynamics and formation history of the Milky Way.

SKILLS & COMPETENCES

1. Advanced statistics and quantitative data analysis

Some highlights (based on papers in the appendix)	[papers]
• Cross-matching stars in multiple data sets	[3,4,5,6]
• Bayesian maximum a posteriori regression analysis	[7]
• Optimization of numerical integrals (>1000 times faster)	[7]
• Modifying algorithms in C/C++ and Fortran	[1,3,9,12]
• Developing an advanced mathematical framework	[9,12]
• Time-series analysis of stellar orbits, orbital frequency analysis	[8]

2. Expert scientific programmer

• 5+ years experience in programming in Python with scientific applications (both scripting and notebooks).
• Creator of comprehensible publication-quality visualizations (featured in scientific papers, newspapers and magazines, documentaries, planetarium shows, and a textbook on galaxy formation).
• Responsible for pre-processing multi-purpose data sets for colleagues and collaborators.
• First-author of 9 papers that inspired several (ongoing) follow-up projects

3. Excellence in research

• Co-author of a seminal paper on the Milky Way's history
• Obtained a membership at the IAS in Princeton

4. Leader & team player

• Secretary and chair (1yr each) of executive board sports club	2011 - 2013
• Founding executive board member (1.5 yr) study association	2016 - 2017

EXTRACURRICULAR ACTIVITIES

Coaching & Teaching

Creating practice exams (2013-2016)
Supervision of students (2019-)

Teaching assistant:

'Intro to Programming' (2017, 2019)
'Dynamics of Galaxies' (2018, 2020)

Communication

20+ scientific talks
10+ public talks
3+ live interviews on local radio
5+ magazine interviews
Creating illustrations and animations for (inter)national media

Leadership & teamwork

Organizational work for the faculty, study association, and sports club:
Sports tournaments
Galas and other social events
Symposium
Faculty introduction camp
Program committee of astronomy
Chair of first-year PhD committee

Machine Learning

Top 5% in a [kaggle.com](https://www.kaggle.com) competition for machine learning where I trained our best performing neural network

Resume Addendum

Selected Talks:

Talks at IAS, Princeton University, Flatiron Institute/CCA	2020-2021
Various talks at institutes in The Netherlands	2016-2020
KITP Santa Barbara: 3-week stay, 'Dynamical Models for Stars and Gas in Galaxies in the Gaia Era'	April-2019
Harvard: lunch talk, 2-day visit	April-2019
Yale: lunch talk, 1-day visit	April-2019
CCA: lunch talk, 2-day visit	April-2019
Shanghai: contributed talk at the 'The life and times of the Milky Way' conference	Nov-2018
Heidelberg: contributed talk at the 'Survival of Dense Star Clusters in the MW' conference	Nov-2018

First authored and relevant co-authored publications

[1]	Koppelman et al. 2018a	arXiv	DOI: arXiv:1804.07530
[2]	Koppelman et al. 2018b	APJ-L	DOI: 10.3847/2041-8213/aac882
[3]	Koppelman et al. 2019a	A&A	DOI: 10.1051/0004-6361/201834769
[4]	Koppelman et al. 2019b	A&A	DOI: 10.1051/0004-6361/201936738
[5]	Koppelman et al. 2020a	A&A	DOI: 10.1051/0004-6361/202038652
[6]	Koppelman & Helmi 2020b	A&A	DOI: 10.1051/0004-6361/202038178
[7]	Koppelman & Helmi 2021a	A&A	DOI: 10.1051/0004-6361/202038777
[8]	Koppelman, Hagen, Helmi 2021b	A&A	DOI: 10.1051/0004-6361/202039390
[9]	Koppelman & Helmi 2021c	A&A	DOI: 10.1051/0004-6361/202039968
[10]	Helmi, Babusiaux, Koppelman, et al. 2018 <i>Contribution: I analyzed a simulation and was responsible for the dynamical analysis (Fig. 1 & 3)</i>	Nature	DOI: 10.1038/s41586-018-0625-x
[11]	Massari, Koppelman, and Helmi 2019 <i>Contribution: I was responsible for the dynamical analysis in this work and assisted in grouping the globular clusters.</i>	A&A	DOI: 10.1051/0004-6361/201936135
[12]	Helmi & Koppelman 2016 <i>Contribution: During my MSc thesis, I modeled dark matter - stream interactions, the results of my thesis led to a paper.</i>	APJ-L	DOI: 10.3847/2041-8205/828/1/L10

List of courses

Programming & statistical methods

Introduction to programming
Computational physics
Statistical Signal Processing
Statistical and numerical methods
Math:
Calculus
Linear algebra
Complex analysis
Vector analysis

Physics:

Mechanics and relativity
Advanced mechanics
General relativity
Astrophysical hydrodynamics
Dynamics of galaxies
Waves and optics
Quantum physics
Electricity & magnetism
Structure of matter

Stellar structure and evolution

Electrodynamics of radiation processes
Particle physics phenomenology
Astroparticle physics
High-energy astrophysics
Cosmic structure formation
Star and planet formation
Formation and evolution of galaxies
Statistical Physics