HELMER HERMAN KOPPELMAN

CONTACT

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LANGUAGES

Spoken

Dutch (native):	●●●●●
English:	●●●●●

Programming

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

LIBRARIES & TOOLS

Data preprocessing and analysis (pandas, vaex, jupyter)	●●●●●
Scientific computing (numpy, scipy, matplotlib)	●●●●●
Dimensionality reduction (t-SNE, UMAP, PCA)	●●●●○
Classification algorithms (xgboost, dbscan, sklearn)	●●●●○
Basic experience with NN (keras, pytorch, normalizing flows)	●○○○○
MCMC simulations	●●●●○
Bayesian analysis	●●●○○
Modifying & optimizing code	●●●●○

PUBLICATIONS

April 2021

	Total	First Author
Submitted	16	9
Refereed	14	8
Citations	802	191

See also Google Scholar

EDUCATION

PhD Astronomy — 2016 - 2020
University of Groningen — **cum laude**

MSc Astronomy — 2014 - 2016
University of Groningen — **cum laude**

BSc Astronomy — 2011 - 2014
University of Groningen

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.

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 integral routines (>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 orbital frequencies   [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.

3. Excellence in research

• First author of 9 papers that inspired several (ongoing) follow-up projects.
• Co-author of a seminal paper on the Milky Way's history.
• Offered 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

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.

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 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: <u>arXiv:1804.07530</u>
[2]	**Koppelman** et al. 2018b	APJ-L	DOI: <u>10.3847/2041-8213/aac882</u>
[3]	**Koppelman** et al. 2019a	A&A	DOI: <u>10.1051/0004-6361/201834769</u>
[4]	**Koppelman** et al. 2019b	A&A	DOI: 10.1051/0004-6361/201936738
[5]	**Koppelman** et al. 2020a	A&A	DOI: <u>10.1051/0004-6361/202038652</u>
[6]	**Koppelman** & Helmi 2020b	A&A	DOI: <u>10.1051/0004-6361/202038178</u>
[7]	**Koppelman** & Helmi 2021a	A&A	DOI: <u>10.1051/0004-6361/202038777</u>
[8]	**Koppelman**, Hagen, Helmi 2021b	A&A	DOI: <u>10.1051/0004-6361/202039390</u>
[9]	**Koppelman** & Helmi 2021c	A&A	DOI: <u>10.1051/0004-6361/202039968</u>
[10]	Helmi, Babusiaux, **Koppelman**, et al. 2018	Nature	DOI: <u>10.1038/s41586-018-0625-x</u>

Contribution: I analyzed the simulation and took care of the dynamical analysis (Fig. 1 & 3)

[11]	Massari, **Koppelman**, and Helmi 2019	A&A	DOI: <u>10.1051/0004-6361/201936135</u>

Contribution: I did the dynamical analysis in this work and assisted in grouping the globular clusters.

[12]	Helmi & **Koppelman** 2016	APJ-L	DOI: <u>10.3847/2041-8205/828/1/L10</u>

Contribution: During my MSc thesis, I modeled dark matter - stream interactions, the results of my thesis led to a paper.

List of courses

Programming & statistical methods	Physics:	Stellar structure and evolution
Introduction to programming	Mechanics and relativity	Electrodynamics of radiation
Computational physics	Advanced mechanics	processes
Statistical Signal Processing	General relativity	Particle physics phenomenology
Statistical and numerical methods	Astrophysical hydrodynamics	Astroparticle physics
Math:	Dynamics of galaxies	High-energy astrophysics
Calculus	Waves and optics	Cosmic structure formation
Linear algebra	Quantum physics	Star and planet formation
Complex analysis	Electricity & magnetism	Formation and evolution of galaxies
Vector analysis	Structure of matter	Statistical Physics