HELMER HERMAN KOPPELMAN

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ABOUT ME

I am a fast learner with a broad interested ranging from science and finance to arts and politics. 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.

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

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: 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	Nature	DOI: 10.1038/s41586-018-0625-x
	Contribution: I analyzed the simulation and took care of the dynamical analysis (Fig. 1 & 3)		
[11]	Massari, **Koppelman**, and Helmi 2019	A&A	DOI: 10.1051/0004-6361/201936135
	Contribution: I did the dynamical analysis in this work and assisted in grouping the globular clusters.		
[12]	Helmi & **Koppelman** 2016	APJ-L	DOI: 10.3847/2041-8205/828/1/L10
	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
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