Jakob Möhrle

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EDUCATION

M.Sc. in Physics , *University of Heidelberg* Oct 2024 - Oct 2025
Heidelberg, Germany

Supervisors: Dr. Anna de Graaff, Prof. Dr. Hans-Walter Rix
Thesis title: Galactic Velocity Dispersion on New Scales
(Preliminary) Grade average: 1.5 (max: 1.0, min: 5.0)

B.Sc. in Physics , *University of Heidelberg* Oct 2019 - July 2024
Heidelberg, Germany

Supervisor: Prof. Dr. Andreas Just
Thesis title: The Search for the Star Formation Efficiency of the Pleiades Using N-body Simulations
Thesis Grade: 1.0, Grade average: 2.0 (max: 1.0, min: 5.0)

Research Projects

Master Thesis , *Max Planck Institute for Astronomy* Nov 2024 - Oct 2025
Heidelberg, Germany

Supervisors: Dr. Anna de Graaff, Prof. Dr. Hans-Walter Rix
Topic: Tracing the evolution of turbulence strength and stellar/baryonic mass fractions for galaxies up to higher redshifts and lower masses than previous studies
Data: JWST high-resolution NIRCSpec spectra and NIRCam photometry in wide and medium bands

- compiled sample of 2657 high-resolution NIRSpec spectra of 1947 galaxies with photometric NIRCam coverage, as well as star formation rates SFRs and stellar masses $M_\star$ from `prospector` SED fits
- fitted Sérsic profiles to each galaxy in up to 14 photometric bands using `pysersic` and `photutils`
- forward modeled the undersampled LSF for each spectrum according to the morpholigical fit results using `msafit`
- retrieved integrated LOS velocity dispersion of the ionized gas $\sigma'_{\mathrm{gas,int}}$ from one-component Gaussian fits to significant ionized gas emission lines for 1011 galaxies using `emcee`
- identified 54 AGN and outflows that contaminate the sample using two-component Gaussian fits
- investigated correlations between $\sigma_{\mathrm{gas,int}}$, $M_\star$, M_{bar}, M_{dyn}, SFR and morphological parameters for over 1000 galaxies and studied their evolution from $z \sim 0.5$ to $z \sim 9$

Research Internship &
Consecutive Bachelor Thesis , *Astronomisches Rechen-Institut* March 2023 - Oct 2023
Heidelberg, Germany

Supervisor: Prof. Dr. Andreas Just

Topic: Estimating the initial star formation efficiency SFE of the Pleiades open star cluster

Data: 3 dimensional positions and velocities of stars from Gaia EDR3

- backwards integrated the Pleiades density center to obtain initial cluster position and velocity
- ran ~ 50 N-body simulations for models with varying SFE values using ϕ-`GRAPE-GPU` and optimized the remaining free parameters for each SFE
- compared best fit models to observational data and evaluated physical plausibility of their formation parameters to find the most probable SFE

Skills

Languages: German (C2), English (C1), French (B2), Spanish (A1)

Programming Languages: Python (very good): `pysersic`, `photutils`, `emcee`, `multiprocessing`, `PyTorch`

Statistical Methods: MCMC, AIC/BIC, bootstrap resampling, ODR, Deep Learning methods

OS: Windows, Mac, Linux

Other: Usage of bash, LaTeX, Microsoft Office, TOPCAT

Workshops, Team Meetings & Science Talks

Rubies collaboration meeting May 2025

Bergen, Netherlands

- gave a science talk presenting my preliminary master thesis results on galactic velocity dispersions
- learned about topics related to the Red Unknowns: Bright Infrared Extragalactic Survey (RUBIES) including LRDs, stellar pop fitting, and galactic kinematics from galaxy evolution experts in the RUBIES collaboration

Interdisciplinary School on ML and AI for Science - ETH Zürich June 2025

Heilbronn, Germany

- presented insights on possible applications of ML and AI in astronomy
- learned about challenges of deep learning-based AI, how to apply it in astronomy and conceptual issues like validation of such learning systems

Additional Work Experience

Cashier, Heidelberg Zoo ($\sim$ 12 hours per week) Sept 2022 - July 2025

Heidelberg, Germany

Private Tutor, Mathematics & Physics for high school students (part-time) 2021 - 2022

Heidelberg, Germany