# Attila Varga

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## Skills

**Programming & Tools**: Python, C++, FORTRAN, MATLAB, Git, Linux, HPC
**Scientific Computing & Data Analysis**: NumPy, SciPy, Pandas, Astropy, Matplotlib, Scikit-learn
**Computational Mathematical Methods**: Numerical integration, model fitting, time series analysis, Runge–Kutta
**Statistical Methods**: Linear regression, hypothesis testing, data clustering
**Optical Systems**: laboratory experience in optical alignment, focal plane arrays, and sensor data acquisition
**Space & Ground Telescopes**: Optical, UV, IR, and X-ray telescope design and mission planning, data analysis & reduction

## Research Experience

**Astrophysics Graduate Research,** Rochester Institute of Technology – Rochester, NY

Stellar Associations — Aug 2020 – Present

- Wrote a 3D stellar traceback algorithm in Python to reconstruct past trajectories of stars from observed kinematics.
- Analyzed over 10,000 stellar motions and broadband magnitudes to infer stellar properties and ages.
- Reduced observational optical, UV, and IR image data and photometric catalogs using custom Python scripts.
- Performed statistical modeling to estimate stellar ages using space telescope data.
- Published in America's best peer-reviewed astrophysical and astronomical journal.

Exoplanet Atmospheres and X-ray Irradiation

- Planned and executed a 2.3m optical telescope program to measure stellar spectra
- Modeled X-ray irradiation and hydrodynamic escape from an exoplanet’s atmosphere using space telescope data.
- Applied Runge-Kutta integration to solve coupled differential equations for atmospheric loss rates.
- Benchmarked models against published statistical studies of exoplanet evaporation.
- Published in America's best peer-reviewed astrophysical and astronomical journal.

Large X-ray Telescope Data Science

- Analyzed optical, UV, and IR data for over 20,000 stars to study clustering and correlations with X-ray observations.
- Employed linear regression, hypothesis testing, and clustering algorithms to model stellar properties.
- Manuscript submitted for peer review.

**Undergraduate Research,** Oregon State University– Corvallis, OR

Proto Stellar Accretion Disk Modeling — Feb 2015 – Aug 2020

- Simulated 3D magnetohydrodynamic instabilities in protostellar and accretion systems using FORTRAN and Matlab.
- Wrote high-resolution non-linear simulations on GPU-based HPC clusters; analyzed outputs using Fourier methods.

## Academic Projects

**Cross-Correlation Image Reconstruction**

- Developed Python and Matlab pipeline to process raw binary X-ray sensor data and reconstruct surface images.
- Applied cross-correlation techniques to identify structural features in experimental image sensors substrates.

**Gaussian Signal Fitting from Astrophysical Sources**

- Modeled optical Gaussian profiles in Python to represent astrophysical emission features.
- Applied curve-fitting techniques to match the model with observed signal data.

**White Dwarf Star Equation of State Simulation**

- Created a C++ simulation using Runge-Kutta methods to integrate equations governing stellar structure.
- Modeled mass-radius relations to estimate the equation of state of white dwarf stars.

**Three-Body Gravitational Solver**

- Built a numerical solver in Python for simulating 3-body gravitational dynamics.
- Computed time-dependent energy and momentum to assess system stability.
- Implemented high-accuracy Runge-Kutta integrators.

**Fundamental Analog Electronics**

- Constructed an operational amplifier using discrete components to understand feedback and gain.
- Explored hysteresis behavior through transistor-based circuit experiments.

**Optical Instrumentation Development**

- Designed and aligned lenses to build a fiber-fed, benchtop laser spectrometer.
- Gained hands-on experience in optical alignment, fiber coupling, and spectroscopy fundamentals.

**University Campus Observatory**

- Hands on experience in telescope mirror alignment, mounting, and computer control systems
- Foundational knowledge in basic telescope pointing and observing campaigns

## Education

**Rochester Institute of Technology** – PhD in Astrophysics — Anticipated Summer 2020

**Rochester Institute of Technology** – MS in Astrophysics — Dec 2023

**Oregon State University** – BS in Physics, Minor in Mathematics — June 2018