

# Farrukh Nauman

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**Objective:** Seeking a full-time position as a data scientist.

## SKILLS

- **Languages:** Python (2+ years), IDL, C, Fortran **Technologies:** GitHub, Bitbucket
- **Machine Learning Libraries:** SCIKIT-LEARN, TENSORFLOW/KERAS, STATSMODELS, PYSPARK
- **Computational Fluid Dynamics:** ATHENA, SNOOPY, PLUTO, PENCIL, SHENFUN
- **Modeling:** (Current) Using machine and deep learning to construct surrogate models of high fidelity simulations of astrophysical fluids.  
(Previous) Theoretical and classical numerical models for astrophysical fluids.

## EXPERIENCE

- (Current) Chalmers University of Technology** Gothenburg, Sweden  
*Origins Fellow (Machine Learning, Astrophysical Fluid Modeling)* Sep 2018 - Present
- **Machine Learning models of dynamos (1+ years, one paper accepted in Astronomy & Astrophysics):** (Blog: [fnauman.github.io](http://fnauman.github.io), Data/code: [github.com/fnauman/ML\\_alpha2](https://github.com/fnauman/ML_alpha2)):
    - \* Designed and setup 10+ high resolution simulations of forced helical magnetohydrodynamic turbulence (FORTRAN).
    - \* Lasso, Random Forests (SCIKIT-LEARN), Randomized Lasso (SCIKIT-LEARN-CONTRIB), Bayesian MCMC (EMCEE). Best: Lasso.
    - \* Feature selection using model ensembling/stacking.
  - **GlobalDisks:** Used a grid-based code PLUTO (written in C) to setup plasma simulations of astrophysical disks around massive stars.

- Niels Bohr Institute** Copenhagen, Denmark  
*Postdoctoral Fellow (Astrophysical Fluid Modeling)* Sep 2015 - Sep 2018
- **LocalDisks:** Setup a pseudospectral fluid code SNOOPY (written in C) to simulate of astrophysical turbulence.
  - **TransitionToTurbulence:** Highlighted the importance of aspect ratio of simulation domains in the transition to turbulence.

## MACHINE LEARNING PROJECTS

- **Time series:** My experience in modeling highly non-linear physical systems (turbulence) has introduced me to a wide variety of algorithms ([github.com/fnauman/timeseries](https://github.com/fnauman/timeseries)):
  - **Deep learning (TENSORFLOW):** CNNs, RNNs, LSTMs, wavenet.
  - **Machine learning (SKLEARN):** Lasso, Random forests, XGBOOST.
  - **Econometrics (STATSMODELS):** Seasonal Autoregressive Integrated Moving Average.
  - **Dynamical systems (NUMPY, SCIPY, SKLEARN):** SINDy algorithm for *identifying differential equations* (and for forecasting).
- **Package for SCIKIT-LEARN models:** ([github.com/fnauman/template\\_travis\\_sklearn](https://github.com/fnauman/template_travis_sklearn)):
  - Modular design: preprocessing, training, testing of SCIKIT-LEARN models.
  - CONTINUOUS INTEGRATION, UNIT TESTING.
  - LOGGING, versioning to address reproducibility.
- **API (FLASK) for SCIKIT-LEARN models inside a DOCKER container:** ([github.com/fnauman/flask\\_api\\_for\\_sklearn\\_docker](https://github.com/fnauman/flask_api_for_sklearn_docker)):
- **PYSPARK, SCIKIT-LEARN, DASK\_ML applied to the iris dataset:** ([https://github.com/fnauman/pyspark\\_models](https://github.com/fnauman/pyspark_models)):

## EDUCATION

- University of Rochester** Rochester, New York (USA)  
*PhD in Physics and Astronomy (Advisor: Eric G. Blackman)* Oct 2015
- Thesis:** Turbulence in Rotating and Non-Rotating Magnetohydrodynamic Shear Flows.
- Quaid-i-Azam University** Islamabad, Pakistan  
*M. Phil. Physics* June 2009
- Thesis:** Modified gravity as an explanation for cosmic acceleration.

## AWARDS AND ACHIEVEMENTS

- HPC-Europa3 travel+computing: (i) NORDITA (March-April 2018: Stockholm, Sweden), (ii) ZARM (March 2019: Bremen, Germany).
- Horton fellowship from Laboratory for Laser Energetics. 2010-2015
- Susumu Okubo Prize for the highest performance on the graduate physics written comprehensive exam and excellence in coursework. 2011

## REFEREING SERVICE FOR JOURNALS

Monthly Notices of Royal Astronomical Society, Journal of Cosmology and Astrophysics, Astrophysical Journal, European Physical Journal Plus

## PUBLICATIONS (RECENT)

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- **Farrukh Nauman**, Joonas Nättilä. 2019. *Exploring helical dynamos using machine learning*. accepted by Astronomy and Astrophysics ([arxiv.org/abs/1905.08193](https://arxiv.org/abs/1905.08193))
- **Farrukh Nauman**, Martin E. Pessah. 2018. *Transport properties of Keplerian flows in extended domains with no imposed field*. MNRAS, 480, 204.
- **Farrukh Nauman**, Eric G. Blackman. 2017. *Shearing box simulations in the Rayleigh unstable regime*. MNRAS, 467, 1652, ([arxiv.org/abs/1507.04711](https://arxiv.org/abs/1507.04711))
- **Farrukh Nauman**, Eric G. Blackman. 2017. *Sustained turbulence and magnetic energy in non-rotating shear flows*. Phys. Rev. E, 95, 033202, ([arxiv.org/abs/1701.03531](https://arxiv.org/abs/1701.03531))

## SELECTED TALKS & POSTERS

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- Machine learning and dynamos  
**Star and Planet Formation, Chalmers** Gothenburg, Sweden, June 17th-20th, 2019.
- Using machine learning to model astrophysical flows  
**Advancing AI, CHAIR (Chalmers)** Gothenburg, Sweden, March 4-5th, 2019
- Energy transfers in turbulent MHD shear flows  
**ZARM**, University of Bremen, Germany. July 25th, 2018
- Magnetized accretion disks  
**Chalmers**, Sweden. May 23rd, 2018