# 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, Data/code: 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):
  - **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):
  - 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):
- **pyspark, scikit-learn, dask_ml applied to the iris dataset**: (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

## Refereeing Service for Journals

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

## Publications (recent)

- **Farrukh Nauman**, Joonas Nättilä. 2019. *Exploring helical dynamos using machine learning*. A&A 629, A89. (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. (arxiv.org/abs/1909.04290)
- **Farrukh Nauman**, Eric G. Blackman. 2017. *Shearing box simulations in the Rayleigh unstable regime*. MNRAS, 467, 1652. (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)

## Selected Talks & Posters

- 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