

# Giovanni Fossati, Ph.D.

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## Profile

- ▣ Scientist with 10+ years research experience in astrophysics on the faculty at a top-tier university actively seeking opportunities in *data science* to apply to real-world challenges my skills, talent and passion for data-driven quantitative analysis, modeling and interpretation.
- ▣ Open-minded inquisitive problem-solver who dealt with broadly defined issues, analyzing, understanding, disaggregating them, identifying their core, and devising effective and practical approaches to solve them.
- ▣ Defined and lead projects from raw data to results and communication. Able to keep the big picture perspective while zooming on the details, a strength nurtured by the experience leading and coordinating work with collaborators and students. Adept at interacting effectively with theorist, observers, and programmers.
- ▣ Effective communicator, able to understand and engage with a wide variety of audiences, thanks to vast experience with collaborative work and delivering talks and lectures, from classrooms to international conferences.

## Research Experience

- Made **influential** contributions to advancing the understanding of Active Galactic Nuclei (AGN), the most luminous objects in the universe, powered by gas accretion onto supermassive black holes at the center of galaxies.
- Worked on problems of different nature (e.g., time variability, population statistics, physics modeling), attacked with a multi-pronged approach encompassing theory, simulations and observations. Strived to create data-driven simulations, folding-in real-world effects to be able to compare models directly with data.
- Top-notch **astrophysics research** has many **parallels** with the best **data science**, for it requires (and develops):
  - ▷ independence
  - ▷ deductive reasoning (hypothesis-testing)
  - ▷ adaptability
  - ▷ curiosity and skepticism
  - ▷ inductive reasoning (discovery)
  - ▷ perseverance
  - ▷ creativity / innovation
  - ▷ *back-of-the-envelope* / heuristic reasoning
  - ▷ will / ability to learnand to exercise them in a quantitative scientific context, supported by strong computing, mathematics, statistics skills.
- **Hands-on experience** on all aspects of a diverse workflow closely aligned with that of data science.
  - ▷ Distill problems into good questions. Frame and structure them into projects.
  - ▷ Identify and collect the required data, from multiple sources. Clean, integrate them.
  - ▷ Multivariate data, often incomplete and biased, and requiring context-specific knowledge.
  - ▷ Exploratory analysis, largely visualization-driven, interrogating the data about the story they are telling.
  - ▷ Design and develop data analysis and modeling methods and codes. Simulations of empirical and physical models.
  - ▷ Interpretation, hypothesis-testing, predictions.
  - ▷ Reporting, dissemination (papers, talks.)
- My research followed two main themes, briefly summarized here highlighting some methods and major results:
  - ▷ To identify and validate the fundamental laws underlying the phenomenology of AGNs.
    - Populations studies: statistical analysis and modeling of multivariate properties of observed samples of objects, accompanied by population-synthesis simulations.
    - **Discovered** global unifying property and formulated the “*power sequence*” hypothesis that transformed our understanding of these objects, laying the foundation of a new paradigm and leading subsequent major advancements.
  - ▷ To understand the nature of cosmic jets, by characterizing their physical conditions and their variations.
    - Multivariate variability studies of individual bright sources: multi-wavelength observations (time-series analysis) and simulations of time-dependent emission models.
    - **First realistic simulations** of variable radiative emission from AGN jets, achieved by developing a state-of-the-art code combining Monte Carlo and Fokker-Planck methods.
- **Accomplishments / Impact:**
  - ▷ Author of over 100 scientific **publications**, with 4,500+ **citations**, *h-index* of 29 [↗ [@myPapers](#)]
  - ▷ Two papers among the most **highly cited** of the last 20 years in the field (top 10 of 5,200+) [↗ [@top10field](#)]
  - ▷ Awarded more than 1 Million USD from highly competitive **NASA grants**.
  - ▷ Research results included in undergraduate and graduate astronomy **textbooks**.

## Related Professional Experience

**Presentations** • Given talks at over 60 International Conferences and Universities.

**Teaching** • Taught for 10 years undergraduate and graduate courses at one of most selective US universities.

Full responsibility for planning/preparing/delivering lectures, material, assessment.

**Scientific writing (and reviewing)** • Grant proposals (*NASA*, *National Science Foundation*) – Telescope-time proposals (*NASA*, *ESA*) – Peer-reviewed articles in all major professional journals.

**Committees** • Served on Department and University Committees, involved with faculty hiring, curriculum development, strategic planning and definition of policies and procedures.

**Research mentoring** • two Ph.D. students and several undergraduate students.

**Project management** • Lead collaborative projects from inception to completion. Defined: scope, milestones, goals – Formulated suitable plan (data, modeling), within resource constraints – Executed/supervised/coordinated: analysis, interpretation, predictions, communication of results.

## Technical Skills

Eclectic and flexible: the result of “organic growth” driven by evolving need and curiosity (scientific and technical).

**Developed/worked with :**

- Large simulation codes for empirical and physical models, also based on Monte Carlo method
- Data analysis pipelines
- Quick iteration, fluid, command-line / scripting magic
- Applications for higher level analysis, statistical computing, and visualization (mostly with R)

**Programming :**

- Advanced : R – perl – Fortran – awk – shell scripting – several astronomy packages.
- Worked w/ : python – C – MySQL – MatLab – IDL – Tcl – git

**Statistical / Machine Learning :**

- regression: linear, non-linear, logistic – MARS – PCA – kNN – SVM – clustering – k-means – decision trees
- random forest – some NLP work

**Publishing :**

- $\LaTeX$  – knitr – Shiny – (R)markdown – HTML – CSS – Open/LibreOffice – MS Office.

## Employment

Rice University (Houston)	Research Scientist	2014 – 2015
Rice University (Houston)	Assistant Professor	2004 – 2014
European Southern Observatory (Chile)	Visiting Scientist	2009 (8–12)
Rice University (Houston)	Faculty Fellow	2001 – 2004
Univ. of California, San Diego	CASS Postdoctoral Fellow	1998 – 2001

## Education and Training

<b>Ph.D.</b>	<b>Astrophysics</b>	International School for Advanced Studies (Trieste, Italy)	1998
<i>Laurea</i> (M.Sc.)	Physics	Università degli Studi di Milano (Milano, Italy)	1994

■ Strengthened **data science skills** via *MOOCs* (66 weeks total):

▷ Coursera : *Johns Hopkins Bloomberg School of Public Health – Data Science Specialization*

- |                                       |                             |                              |
|---------------------------------------|-----------------------------|------------------------------|
| ◦ The Data Scientist's Toolbox        | ◦ Exploratory Data Analysis | ◦ Regression Models          |
| ◦ R Programming                       | ◦ Reproducible Research     | ◦ Practical Machine Learning |
| ◦ Getting and Cleaning Data           | ◦ Statistical Inference     | ◦ Developing Data Products   |
| ◦ Data Science Capstone Project (NLP) |                             |                              |

▷ Coursera : *Stanford*

- Machine Learning

▷ edX : *CalTech*

- Learning From Data

▷ edX : *MIT*

- The Analytics Edge

## Additional Personal Information

**Citizenship** • USA / Italy / Switzerland

📄 **Open to relocation**

**Languages** • English (fluent) / Italian (mother tongue) /

Spanish (good verbal and reading, fair writing) / French (fair)