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Ph.D., Astrophysics
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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-level **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

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.

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

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.

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.

Technical Skills

Eclectic and flexible skill set, result of “organic growth” driven by evolving need and curiosity (scientific and technical).

■ Examples of *Data Science* work posted at ↗ pedrosan.github.io

Developed/worked with :

- Large simulation codes for empirical and physical models (also parallel) – Monte Carlo simulations
- Data analysis pipelines, from raw data to modeling
- Scripts – command line
- Applications for higher level analysis, statistical computing, and visualization (mostly with R)

Programming :

- Advanced : R – perl – Fortran – awk – unix/linux 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

Ph.D.	Astrophysics	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**

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|---------------------------------------|-----------------------------|------------------------------|
| ◦ 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)