

Dr. Lorenzo Spina

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RESEARCH INTERESTS

I am an expert in stellar spectroscopy with 8 years of experience in top research institutes around the globe. Through my research activity, I tackle the most challenging open questions regarding the structure and evolution of the **Milky Way** by studying ages, kinematics, and chemical compositions of Galactic **stellar populations**.

I am deeply involved with important international collaborations such as **4MOST**, **Gaia**, **Gaia-ESO**, **GALAH**, **WEAVE** and other networks committed to the scientific exploitation of future spectrographs.

Present and future Galactic surveys are causing a nearly insurmountable data avalanche which will rapidly increase its size in the following years. I possess skills in advanced statistical analysis, such as **Bayesian methods**, and **Machine Learning** algorithms, which are strategical for the exploitation of these large data sets at their maximum potential. These techniques are transferable also to a broad range of fields, and disciplines.

I am also expert in **high-precision spectroscopy**, a novel approach to measuring elemental abundances in stars with the highest precision to date. My research interests also include the **star-planet chemical connections** that can be unveiled at such high precision.

I have experience in **student supervision** and **lecturing**. I have delivered courses on observational astronomy at Monash University and on machine learning techniques at the University of Padua.

PROFESSIONAL EXPERIENCE

Nov 2020 – present	Postdoctoral Fellow INAF - Astronomical Observatory of Padua <ul style="list-style-type: none">Galactic archaeologyValidation Gaia DR3 datasetStar-Planet chemical connection
Nov 2017 – Oct 2020	Postdoctoral Fellow Monash University <ul style="list-style-type: none">Galactic archaeologyStar-Planet chemical connectionExoplanets
Jan 2015 – Sep 2017	Postdoctoral Fellow University of Sao Paulo <ul style="list-style-type: none">Galactic archaeologyStar-Planet chemical connectionExoplanets
Jul 2014 – Nov 2014	Research Fellow INAF - Astronomical Observatory of Arcetri <ul style="list-style-type: none">Galactic archaeologyValidation Gaia-ESO dataset
Sep 2009 – Jan 2010	Research Fellow NASA - Space Telescope Science Institute <ul style="list-style-type: none">Imaging of protoplanetary disks

EDUCATION

Jan 2011 – Jan 2014	Ph.D., Physics and Astronomy University of Florence Thesis: “Metal abundances of star forming regions and young clusters: towards a new paradigm with the Gaia-ESO Survey” Supervisors: Dr. F. Palla, Dr. S. Randich
Jan 2008 – Jul 2010	Master, Physics and Astronomy University of Florence Thesis: “Disks and jets from T Tauri stars and brown dwarfs in the stellar formation region Chamaeleon I” Supervisor: Dr. F. Palla
Sep 2004 – Jan 2008	Bachelor, Physics and Astronomy University of Florence Thesis: “Characterization of a liquid crystal variable retarder (LCVR) for applications in solar polarimetry” Supervisor: Dr. M. Romoli

REFEREED JOURNAL ARTICLES

| 68 publications.

| 15 papers as first or supervising author & other 4 papers as second or third author.
These 19 “lead-authored” papers constitute about 1/4 of my publications.

| 1800+ citations in total.
550+ citations from lead-authored papers.

| h-index = 25
h-index = 15 from lead-authored papers.

| m-index = 2.4 [h-index (26)/ years (2022-2012)]
“A value of m-index=2, characterizes outstanding scientists, likely to be found only at the top universities or major research laboratories.” [Hirsch \(2005\)](#).

ACADEMIC PRESENTATIONS

| 10 invited departmental colloquia, seminars & talks.
Osservatorio di Astrofisica e Scienza dello Spazio di Bologna (Italy); Australian National University (Australian Capital Territory, Australia); National Observatory (Rio de Janeiro, Brazil); Swinburne University (Victoria, Australia); University of Sydney (NSW, Australia); Macquarie University (NSW, Australia); University of Southern Queensland (Queensland, Australia); Vatican Observatory (Italy); University of Sao Paulo (Sao Paulo, Brazil); Astrophysical Observatory of Arcetri (Italy)

| 5 invited conference seminars & talks.
Stellar Spectroscopy and Astrophysical Parameterization from Gaia to Large Spectroscopic Surveys; Stars in Canberra; Precision Spectroscopy 2017; Francesco’s Lecacy - Star Formation in Space and Time; Young Clusters in the Gaia-ESO Survey

| 30+ conference talks.

SUPERVISION

2020–2021	Parth Sharma	Undergrad., Monash University	Publication on Nature Astronomy
2019–2021	Giada Casali	Ph.D., University of Florence	1 student-led papers
2019	Tushar Nagar	Undergrad., Monash University	1 student-led paper

TEACHING

2022	Lecturer of the course “Hands-on machine learning course with Python” (16 hours) University of Padua, PhD course	<ul style="list-style-type: none"> • Evaluation metrics, feature engineering. • Supervised machine learning algorithms. • Dimensionality reduction. • Clustering algorithms.
2020	Lecturer of the course “ASP2011 - Astronomy” (18 hours) 2 nd year, Monash University	<ul style="list-style-type: none"> • Optical systems, aberrations, telescopes. • Atomic transitions. • Light diffraction and spectroscopy. • CCDs. • Adaptive optics, interferometry. • Exoplanets, detection techniques.
2019	Guest lecturer, school “From Galileo to GPS: how science shapes society” (2 hours) Undergraduates, Monash University	<ul style="list-style-type: none"> • Star-Planet connections.
2018	Guest lecturer, course “Origin of the elements” (2 hours) Honours, Monash University	<ul style="list-style-type: none"> • Galactic chemical evolution.

GRANTS

- FAPESP 2014 Post-doctorate fellowship (BLR 106k pa).
- FONDECYT 2014 Post-doctorate fellowship (CLP 24,400k pa). Declined.
- XXXth IAU General Assembly Grant (EUR 700).

GRANTED TIME AT COMPETITIVE TELESCOPES (P.I. only)

- HARPS @ 3.6m-La Silla (9 nights; Apr-Sep 2019)
- HARPS @ 3.6m-La Silla (7 nights; Aug-Sep 2018)
- HDS @Subaru Telescope (1 night; May 2018)
- UCLES @Anglo-Australian Telescope (3 nights; January 2018)
- HIRES @Keck (1.5 nights; December 2017)
- UVES @VLT-ESO (10 hours; Nov-Dec 2017)
- Graces @Gemini-North (7.7 hours; Nov-Dec 2016)
- UVES @VLT-ESO (11.8 hours; Nov-Dec 2015)

- Graces @Gemini-North (10.5 hours; Nov-Dec 2015)

OBSERVING RUNS

- DEIMOS at the Keck telescope (Mauna Kea, Hawaii).
- HARPS at the 3.6m telescope (La Silla, Chile).
- HDS at the Subaru telescope (Mauna Kea, Hawaii).
- HIRES at the Keck telescope (Mauna Kea, Hawaii).
- Goodman at the SOAR Telescope (Cerro Pachon, Chile).
- MUSICOS at the 1.6m Perkin-ELMER Telescope (Observatorio Pico dos Dias, Brazil).
- SARG at the Telescopio Nazionale Galileo (Las Palmas, Spain).
- UCLES at the Anglo-Australian Telescope (Siding Spring Observatory, Australia).

PROFESSIONAL SERVICES

Membership to Galactic surveys and international collaborations

- Member of the Gaia Data Processing and Analysis Consortium (validation Gaia DR3 dataset; scientific exploitation).
- Member of the Gaia-ESO Survey (node leader; scientific exploitation).
- Member of the GALAH Survey (scientific exploitation).
- Member of Stellar Population Astrophysics Programme (scientific exploitation).
- Member of the WEAVE Survey (scientific exploitation).
- Member of “4MOST Survey of Young Stars” (scientific exploitation).
- Member of “Stellar Clusters in 4MOST” (roles of responsibility, scientific exploitation).
- Member of the science advisory groups for MAVIS and HRMOS spectrographs (science team member; providing simulation for instrument design).
- Member of the “Maisha Enterprise”, an interdisciplinary project devoted to understanding the potential habitability of extraterrestrial environments (developing Artificial Neural Networks for planetary habitability prediction).

Roles of responsibility

- Representative of the “Stellar Clusters in 4MOST” survey within the 4MOST “Survey Strategy and Simulations” working group (ongoing).
- Responsible for the machine learning algorithm development of the “Maisha Enterprise” project (ongoing).
- Guest editor for the international peer-reviewed open access journal Universe (ongoing).
- Leader of the UVES/Arcetri node within the Gaia-ESO Survey (2011-2014).

Editoring/Refereeing/Committee

2020 — Present	Guest editor of the special issue “Star clusters” of Universe (ISSN 2218-1997). Impact factor: 2.278.
2017 — Present	Referee for Monthly Notices of the Royal Astronomical Society, Astronomy & Astrophysics, and Astrophysical Journal.
2019	Assessor of proposals for observations at the Canary Islands telescopes.

Seminars/Conferences

Dec 2019 – Oct 2020	Organisation of Astro Seminars and Colloquia at the School of Physics and Astronomy, Monash University.
Dec 2019	Member of the Science Organisation Committee for Stars in Melbourne workshop.
Aug 2017	Member of the Local Organisation Committee for Precision Spectroscopy workshop.
Sep 2016	Member of the Science Organisation Committee for Precision Spectroscopy workshop.
Nov 2014	Member of the Local Organisation Committee for the Gaia-ESO WG10-11 workshop.

CODES

All my codes are publicly available at my GitHub page (<https://github.com/spinastro>):

- isochrone-interpolator and stellar age calculator;
- automatic pipeline for HARPS spectra reduction;
- Galactic orbits calculator;
- machine learning algorithm for chemical clocks (XGBoost regressor);
- machine learning algorithm for open cluster membership analysis (Support Vector Machine classifier);
- machine learning algorithm for open cluster identifier (OPTICS clustering algorithm);
- machine learning algorithm for chemical tagging (OPTICS clustering algorithm);
- machine learning algorithm for spectral synthesis (Artificial Neural Network);
- machine learning course: teaching material, exercises;

COMMUNITY ENGAGEMENT

Outreach

2021 – Present	Outreach activity in primary schools with the “ViviPadova” project.
2016 – Present	Honorary member of the astrophile association “AstronomiAmo”.
2015 — 2017	Outreach activity for after-school programs in undeveloped area and penal institutions (Brazil).
2012 — 2014	Outreach activity and tour guide at the Astronomical Observatory of Arcetri (Italy).
2006 — 2007	Coordinator of “Student Point”, a student organisation for scientific outreach financed by the University of Florence.

Media

Press release by Media INAF	Link
Highlight on ANSA	Link
Highlight on Sky TG24	Link
Interviewed by Co.Scienza podcasts	Link
Article on The Conversation	Link
Interviewed by Science	Link
Interviewed by Vice.com	Link
Interviewed by The New Scientist	Link
Press release by Media INAF	Link
Press release by INAF - Astrophysical Observatory of Arcetri	Link
Interviewed by AstronomiAmo	Link
Interviewed by AstronomiAmo	Link
Interviewed by Segmento	Link
Interviewed by Astronomy Australia	Link

Date: Friday, 8 April 2022