Sergio Martin-Alvarez | KIPAC Fellow
Stanford University

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Professional Appointments

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KIPAC Fellow, KIPAC — Stanford University — ***09/2022 – Present***
Churchill College By-Fellow, Churchill college — University of Cambridge — ***10/2019 – 08/2022***
Research Associate, Institute of Astronomy & KICC — University of Cambridge — ***08/2019 – 08/2022***

Pre-doctoral Experience

Balzan Fellow, Balzan Centre for Cosmological Studies — IAP (Paris) — ***04/2019 – 06/2019***
UV Research Scholarship, Department of A&A — Universitat de València — ***06/2015 – 09/2015***
IAC Research Scholarship, IAC — Instituto de Astrofísica de Canarias — ***06/2014 – 09/2014***

Education

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PhD, Astrophysics — University of Oxford — ***10/2015 – 06/2019***
Thesis: Magnetic fields in and around galaxies. — With J. Devriendt & A. Slyz

MSc, Theoretical Physics & Astrophysics — Universitat de València — ***09/2014 – 07/2015***
1st class degree. Thesis: Cosmological shock waves. — With V. Quilis

MPhys, Physics & Astrophysics — University of Leeds — ***09/2013 – 06/2014***
Erasmus, 1st class degree. Thesis: Blowouts Evolution in ISM Bubbles. — With J. Pittard

BSc, Physics — Universitat de València — ***10/2010 – 06/2014***
Awarded fully-funded excellence scholarship (5 years, BSc & MSc)

Honors & Awards

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Fellowships, Scholarships and Prizes

2022 – Present: KIPAC Fellowship. — Stanford University
June 2024: Kavli Short-term Visitor Fellowship. — University of Cambridge
2024: Nova Talent Top 10 Research & Academia List (Under 35), Spain. Ranked 1st. — Nova Talent
2019 – 2022: Churchill postdoctoral By-Fellowship. — Churchill College, University of Cambridge
2018: Balzan Visitor Fellowship (to visit IAP). — Balzan Centre for Cosmological Studies
2018: Award for excellence in 'Contribution to Access and Outreach'. — University of Oxford
2017: Highly commended SEPnet communication awards - Stargazing Team. — SEP Network
2015 – 2019: Hintze Doctoral Scholarship. — University of Oxford
2015: Summer Research Scholarship. — Universitat de València
2014: Summer Research Scholarship — Instituto de Astrofísica de Canarias
2013 – 2014: Erasmus Scholarship. — University of Leeds
2010 – 2015: Fully-funded University Scholarship — CMU San Juan de Ribera

Computing Time (as Principal Investigator)

Awarded computational time (in 10^6 CPU hours – MCPUh) listed corresponds **exclusively** to projects for which I was the PI. Full proposals associated with subprojects received higher total amounts (e.g., SPHINX, 68 MCPUh). I have been awarded ∼ 70 MCPUh to generate my own numerical simulations. Industry standards value CPUh at ∼$0.014/CPUh or £0.01/CPUh (e.g., St Andrews HPC Service; AMD EPYC Amazon EC2; Cambridge CSD3 HPC Service (internal cost)).

These awards, combined with my track record on simulation software development and generating my own numerical simulations illustrate my independence as a numerical astrophysicist.

Total: 67.15 MCPUh, total computing time awarded as principal investigator — ***2015–Present***
Estimated total value: $880,000 (£671,500)

9 MCPUh. PI, Understanding radio and FIR Polarimetry with Simulations.	DiRAC, UK	***2023***
10 MCPUh. co-PI, Primordial Magnetic Fields and Dwarf Galaxies.	DiRAC, UK	***2023***
20 MCPUh. PI, The First RTCRMHD Galaxy Formation Simulations.	DiRAC, UK	***2021***
9 MCPUh. Subproject PI, The Influence of PMFs on Cosmic Baryons.	DiRAC, UK	***2021***
2 MCPUh. PI, The Impact of Magnetic Fields on the ISM of Galaxies.	ARC, Oxford	***2017–2019***
12 MCPUh. Subproject co-PI, Magnetic Gields in the Epoch of Reionization.	PRACE, EU.	***2018***
4.5 MCPUh. Subproject PI, Magnetized Galaxy Formation in the SKA Era.	DiRAC, UK	***2018***
0.65 MCPUh. PI, Magnetic Fields in Galaxy Formation.	ARCHER, UK	***2015–2016***

Grants

2022: (Co-I) NASA Astrophysics Decadal Survey Precursor Science ($ 839 653).

2015 - Present: Minor grants (visitor, research, etc.) amounting to ∼ $14,000, and excluding all professional appointment awards.

Publication List

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An up-to-date list of my publications and additional information can be found on my website and on ADS.

Underlined paper titles for each publication provide hyperlinks to each publication in the electronic version of this CV.

Refereed publications as lead author

1, S. Martin-Alvarez, M. Rey, D. Sijacki, A. Queen, M. Haehnelt, et al. ***MNRAS, in prep.***
The Pandora project - III. Cosmic rays and radiation coupling drive the formation of UFD galaxies 19pp, 11 figures

2, S. Martin-Alvarez, D. Sijacki, M. Haehnelt, Y. Yuan, et al. ***MNRAS, submitted soon***
The Pandora project - II. non-thermal physics drive episodic SF & continued outflows in dwarfs 17pp, 12 figures

3, S. Martin-Alvarez, V. Irsic, S. Koudmani, M. Bourne, L. Bigwood, et al. ***MNRAS, submitted***
Stirring the cosmic pot: how black hole feedback shapes the MPS in the Fable simulations 17pp, 13 figures

4, S. Martin-Alvarez, E. Lopez-Rodriguez, T. Dacunha, A.S. Borlaff, S.E. Clark, et al. ***ApJ, 2024***
A Tomographic View of FIR and Radio Polarimetric Observations through MHD Sims. of Galaxies 35pp, 17 figures

5, S. Martin-Alvarez, D. Sijacki, M.G. Haehnelt, M. Farcy, Y. Dubois, et al. ***MNRAS, 2023***
Pandora project - I. Impact of RT, MHD, and CRs on baryonic and DM dwarf properties 26pp, 15 figures

6, S. Martin-Alvarez, J. Devriendt, A. Slyz, D. Sijacki, et al. ***MNRAS, 2022***
Towards convergence of turbulent dynamo amplification in cosmological simulations 20pp, 17 figures

7, S. Martin-Alvarez, H. Katz, D. Sijacki, J. Devriendt, and A. Slyz ***MNRAS, 2021***
Unraveling the origin of magnetic fields in galaxies 19pp, 13 figures
Featured in scientific magazines such as New Scientist

8, S. Martin-Alvarez, J. Devriendt, A. Slyz, and C. Gomez-Guijarro ***MNRAS, 2020***
How primordial magnetic fields shrink galaxies 23pp, 15 figures
Featured in magazines such as New Scientist.

9, S. Martin-Alvarez, J. Devriendt, A. Slyz, and R. Teyssier ***MNRAS, 2018***
A three-phase amplification of the cosmic magnetic field in spiral galaxies 24pp, 20 figures

10, S. Martin-Alvarez, S. Planelles, and V. Quilis ***ApSS, 2017***
On the interplay between cosmological shock waves and their environment 16pp, 10 figures
Journal issue cover picture

Refereed publications as co-first author or with primary involvement

11, T. Dome, S. Martin-Alvarez, and S. Tachella ***MNRAS, submitted soon***
Increased Burstiness at High Redshift in Multi-Physics Models Combining SN, RT and CR
Makes use of my new RTCRMHD cosmological high-res simulations.

12, C. Witten, N. Laporte, S. Martin-Alvarez, D. Sijacki, et al. ***Nature Astronomy, 2024***
Deciphering Lyman-alpha Emission Deep into the Epoch of Reionisation
Makes use of my new RTCRMHD cosmological high-res simulations. Performed all the simulation analysis.

13, H. Katz & S. Martin-Alvarez, J. Rosdahl, T. Kimm, et al. ***MNRAS, 2021***
Introducing SPHINX-MHD: The Impact of Primordial Magnetic Fields [...]

14, H. Katz & S. Martin-Alvarez, J. Devriendt, A. Slyz, and T. Kimm ***MNRAS, 2019***
Magnetogenesis at cosmic dawn: tracing the origins of cosmic magnetic fields

Co-first authored

Refereed publications from supervised & advised students

15, Y. Yuan, S. Martin-Alvarez, M.G. Haehnelt, T. Garel, L. Keating, et al. ***MNRAS, in prep.***
Extended red wings and the visibility of reionization-epoch Lyman alpha emitters

16, D. Maglioni, S. Martin-Alvarez, E. Lopez-Rodriguez, and S.E. Clark ***ApJ, in prep.***
The interrelation between magnetic field orientation and gas density structures in the ISM of galaxies

17, M. Zhu, E. Lopez-Rodriguez, S. Martin-Alvarez, and S.E. Clark ***ApJ, in prep.***
Voronoi tessellation adaptive spatial remapping of Stokes parameters for polarimetric observations

18, T. Dacunha, S. Martin-Alvarez, E. Lopez-Rodriguez, and S.E. Clark ***ApJ, submitted***
The overestimation of equipartition magnetic field strengths from synchrotron emission [...]

19, M. Sanati, S. Martin-Alvarez, J. Schober, and Y. Revaz ***A&A, 2024***
Dwarf galaxies as a probe of a primordially magnetized Universe

20, Y. Yuan, S. Martin-Alvarez, M.G. Haehnelt, T. Garel, and D. Sijacki ***MNRAS, 2024***
Lyα emission as a sensitive probe of feedback-regulated LyC escape at high and low redshift

21, F. Rodriguez-Montero, S. Martin-Alvarez, A. Slyz, J. Devriendt, et al. ***MNRAS, 2024***
The impact of cosmic rays on the ISM and galactic outflows of Milky Way analogues

22, F. Rodriguez-Montero, S. Martin-Alvarez, D. Sijacki, A. Slyz, J. Devriendt, et al. ***MNRAS, 2021***
Momentum deposition of Supernovae with Cosmic Rays

Refereed publications as contributor

23, J. Lee, T. Kimm, J. Blaizot, J. Devriendt, H. Katz, S. Martin-Alvarez et al. ***MNRAS, submitted soon***
Jellyfish Galaxies in Magnetic Fields: Insights from Numerical Simulations

24, A.S. Borlaff, E. Lopez-Rodriguez, R. Beck, S.E. Clark, et al. including S. Martin-Alvarez ***ApJ, 2023***
SALSA Legacy Program. V. First Results on the Magnetic Field Orientation of Galaxies

25, E. Lopez-Rodriguez, A.S. Borlaff, R. Beck, W.T. Reach, et al. including S. Martin-Alvarez ***ApJ, 2023***
SALSA Legacy Program: The Magnetic Fields in the Multiphase ISM of the Antennae Galaxies

26, J. Rosdahl, J. Blaizot, H. Katz, T. Kimm, et al. including S. Martin-Alvarez ***MNRAS, 2022***
LyC escape from SPHINX galaxies in the Epoch of Reionization

27, E. Lopez-Rodriguez, S.A. Mao, R. Beck, A.S. Borlaff, et al. including S. Martin-Alvarez ***ApJ, 2022***
SALSA Legacy Program. IV. Program Overview and First Results on the Polarization Fraction

28, E. Lopez-Rodriguez, M. Clarke, S. Shenoy, W. Vacca, et al. including S. Martin-Alvarez ***ApJ, 2022***
SALSA Legacy Program. III. First Data Release and On-the-fly Polarization Mapping Characterization

29, M. Farcy, J. Rosdahl, Y. Dubois, J. Blaizot, and S. Martin-Alvarez ***MNRAS, 2022***
RMHD simulations of cosmic ray feedback in disc galaxies

30, H. Katz, J. Rosdahl, T. Kimm, T. Garel, et al. including S. Martin-Alvarez ***MNRAS, 2022***
The Nature of High $[OIII]_{88\mu m}/[CII]_{158\mu m}$ Galaxies in the Epoch of Reionization [...]

31, O. Attia, R. Teyssier, H. Katz, T. Kimm, S. Martin-Alvarez, et al. ***MNRAS, 2021***
Cosmological magnetogenesis: the Biermann battery during the Epoch of reionization

32, C. Gómez-Guijarro, G. E. Magdis, F. Valentino, S. Toft, et al. including S. Martin-Alvarez ***ApJ, 2019***
Compact Star-Forming Galaxies as Old Starbursts Becoming Quiescent

33, N.E. Chisari, A.J. Mead, S. Joudaki, P.G. Ferreira, et al. including S. Martin-Alvarez ***OJA, 2019***
Modelling baryonic feedback for survey cosmology

Experience

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Teaching Experience

Note: supervisors (Cambridge) and tutors (Oxford) are roles with similar responsabilities to those of teaching assistants.

Guest Lecturer, Computational Physics (Phys 113) Stanford University ***2024***
Supervisor, Statistical Physics (3rd year) University of Cambridge ***2020–2021***
Supervisor, Stellar Dynamics & Structure of Galaxies (3rd year) University of Cambridge ***2019–2021***
Tutor, C1 Astrophysics (MPhys) University of Oxford ***2016–2019***
Junior Demonstrator, Astrophysics Laboratory (3rd year) University of Oxford ***2016–2019***
Scholarship Panel Lead Examiner, Physics, English, and Logic CMU San Juan de Ribera ***2015***

Conversation Tutor & Group Leader, Spanish (1st year) University of Leeds ***2013–2014***

I have also taught several one-off lectures aimed at undergraduate and graduate students on topics such as programming with Python, employing HPC facilities, hydrodynamics, numerical hydrodynamics, and the fundamentals of numerical simulations, amongst others.

Public Outreach Service

Invited Lecturer, Starlight Festival — Starlight Foundation ***2024***

Outreach collaborator, Noches Astronómicas (Outreach in Spanish) — Stanford University ***2022–Cont***

Executive Committee, KIPAC Community Day (>3000 attendees) — Stanford University ***2022***

Organiser and coordinator for the lectures series, speakers, and presentations.

Executive Committee, Oxford Stargazing (∼1500 attendees per edition) — University of Oxford ***2016–2018***

Science stands organiser, coordinator, and Section Leader

Outreach Graduate Coordinator, Department of Astrophysics — University of Oxford ***2016–2018***

Organiser for fortnightly events, workshops for children, and telescope nights.

President & Founder, Students society for Divulgacion Científica (València) — DivCien ***2014–2015***

Community Service, Management, and Communication

Scholars Selection Committee, KIPAC Post-Baccalaureate — KIPAC, Stanford University ***2024***

Meeting Organiser, Cosmic Magnetism informal group meetings — Stanford University ***2022–2024***

Scientific Reviewer, Consolidated Grants panel — STFC, UK ***2019***

Postdoc Committee Member, Institute of Astronomy — University of Cambridge ***2020–2022***

Organiser, Postdoc Welcome Week (1^{st}Ed.), Institute of Astronomy — University of Cambridge ***2020–2022***

Seminar Organiser, Galaxies Journal Club — University of Cambridge ***2020–2022***

Seminar organiser, Galaxy Evolution Seminar — University of Oxford ***2019–2020***

Seminar organiser, Simulators Meeting — University of Oxford ***2018–2020***

Graduate Community Committee, Christ Church college — University of Oxford ***2018–2020***

Multiple elected roles, devoted to promote community welfare and inclusion

Welfare Officer (2015-2016), Social Secretary (2015-2016), Ethics & Environment (2016), Dining Officer (2016-2018).

Scholarship Selection Committee, CMU San Juan de Ribera — Universitat de València ***2015–2016***

Student Representative, Physics Society — Universitat de València ***2012–2015***

Students Elected Representative, Physics MSc — Universitat de València ***2014–2015***

Students Elected Representative, Physics BSc — Universitat de València ***2013–2014***

Conference Organising Committee, 4 events ***2021–Present***

Scientific Peer Reviewer, for the journals: MNRAS, OJA, ApJ, A&A ***2019–Present***

In addition to my participation in the official programs listed below, I have mentored various students at multiple stages of their careers. Some being my former research & academic students, or high school ones I met during outreach events.

Postgraduate students mentor, Churchill College — University of Cambridge ***2019–2022***

Postdoctoral mentor, Institute of Astronomy — University of Cambridge ***2020–2022***

Mentor for International Students, School of Physics — Universitat de València ***2014–2015***

Mentor for Freshmen Students, School of Physics — Universitat de València ***2012–2013***

Miscellaneous Scientific Experience

Support astronomer, Department of A&A — Universitat de València ***02/2015 – 05/2015***

Higgs-$\tau\bar{\tau}$ analysis intern, ATLAS, CERN — Universitat de València ***06/2013 – 09/2013***

Supervised Students

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Main supervisor for research project is underlined, being highlighted based on scientific advising for the research project.

Graduate Students

Tara DaCunha, Stanford, PhD rotation project, main supervisor ***04/2023 – Present***

Closing the loop: matching synthetic and real radio observations of galaxies — With E. Lopez-Rodriguez & S.E. Clark

Yuxuan Yuan, Cambridge, PhD projects, co-supervisor ***09/2021 – Present***

Lya emission as a sensitive probe of feedback-regulated LyC escape — With M.G. Haehnelt & D. Sijacki

Francisco Rodriguez-Montero, Oxford, PhD projects, CR science main advisor ***09/2020 – Present***

Cosmic ray feedback in simulations of spiral galaxies — With J. Devriendt & A. Slyz

Shenghua Liu, Stanford, PhD rotation project, main supervisor ***09/2023 – 01/2024***
The impact of primordial magnetic fields on the matter power spectrum With S.E. Clark
Mahsa Sanati, EPFL, PhD projects, MHD simulation science main advisor ***09/2019 – 04/2023***
The impact of primordial magnetic fields on dwarf galaxies With J. Schober & Y. Revaz
Jack Dinsmore, Stanford, PhD rotation project, main supervisor ***Autumn 2022***
Resolved properties of magnetic field in simulated galaxies With E. Lopez-Rodriguez & S.E. Clark
Charlie Brooker, Cambridge, MSc project, main supervisor ***09/2021 – 06/2022***
Galaxy formation and black hole evolution in MHD simulations with AGN With D. Sijacki
Rahma Alfarsy, Cambridge, MSc project, main supervisor ***09/2020 – 06/2021***
MHD simulations on the emergence of supermassive black holes during cosmic dawn With D. Sijacki
Francisco Rodriguez-Montero, Cambridge, MSc project, main supervisor ***09/2019 – 09/2020***
MHD simulations of SNe with cosmic rays With D. Sijacki

Undergraduate and Summer Research Students

Students working towards writing a publication from their undergraduate research are highlighted with *
Azana Queen*, Stanford, undergrad. research, co-main supervisor ***04/2023 – Present***
Evaluating the accuracy of IFU velocity measurements with UFD galaxy simulations With M.D.L. Reyes & R. Wechsler
Diego B. Maglione*, Stanford, undergrad. research, main supervisor ***01/2023 – Present***
Magnetic field alignment with density gradients in simulations of galaxies With E. Lopez-Rodriguez & S.E. Clark
Mark T. H. Zhu*, Stanford, undergrad. research, co-supervisor ***Summer 2023 – Present***
Pixelation techniques to reconstruct polarimetric signals in observations With E. Lopez-Rodriguez & S.E. Clark
Yujina Basnet, Stanford, undergrad. research, main supervisor ***Summer 2023***
Tracing the pollution of intergalactic magnetic fields from galactic outflows With E. Lopez-Rodriguez & S.E. Clark
Jacob Gunn & Stefano Zazzera, Cambridge, Summer scholars, main supervisor ***Summer 2020***
The impact of magnetic fields on the LCDM cusp-core problem
Petr Jakubcik, Oxford, undergrad. research, main supervisor ***09/2018 – 09/2019***
Magnetic field amplification during galaxy mergers With J. Devriendt & A. Slyz

Scientific Presentations (Selected 10 from the past 5 years)

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I have presented more than 40 talks, with more than half of those being invited talks and seminars
1 Invited Seminar, Galaxies Seminar, IoA, Cambridge, UK ***2024***
2, AAS Winter Meeting, New Orleans, USA ***2024***
3, IAP colloquium: New simulations for new problems in galaxy formation, IAP, Paris, France ***2023***
4 Invited Talk, The Physics of Cosmic Rays Workshop, Lyon, France ***2023***
5 Invited Talk, CGI Seminar (UCSC), Santa Cruz, USA ***2023***
6 Invited Participant, Recent Advances in Galaxy Formation and Reionization, Seoul, Korea ***2022***
7 Invited Talk, Astrophysics Seminar, University of Surrey, UK ***2022***
8 Invited Talk, IAU H1 Commission - The Local Universe (virtual) ***2021***
9, Cosmic Turbulence and Magnetic Fields, Cargèse, France ***2019***
10 Invited Talk, Galaxies Seminar, Institut d'Astrophysique de Paris, France ***2019***