





Muñoz Rodríguez Iván

PhD student

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SCIENTIFIC PROFILE

In the last 2.5 years of my PhD I have been building up specific expertise in the studies of supermassive black holes (SMBHs), clusters of galaxies and semi-empirical modelling techniques based on N-body cosmological simulations. I have developed a methodology to produce realistic Active Galactic Nuclei (AGN) mock catalogues based on observed X-ray AGN populations. One of the key features of the model is the possibility of implementing selection effects of particular observations which allows a forward comparison between simulations and observations. I am using these catalogues to study the effects of the environment as an AGN-triggering mechanism. I found that the environment plays an important role which also evolves with cosmic time. In the local Universe, AGN activity is suppressed in the densest regions with respect to low-dense environments. However, this relation appears to be reversed for earlier cosmic times, where AGN activity is promoted in high-dense regions with respect to the low-density ones (see publication 2 below). Following this work, I am currently studying the radial distribution of AGN in massive clusters at redshift around 1. I found that current observations of AGN overdensities in the outskirts of massive clusters could be explained just because of projection effects of serendipitous lines of sight, without invoking additional physical processes that enhance AGN activity in these regions.

SPECIFIC EXPERTISE

- Semi-empirical/empirical modelling
- Forward modelling
- Cosmological N-body simulations of galaxies and AGN
- Object oriented programming

EDUCATION

PHD IN ASTRONOMY | STUDENT

October 2020 – Current | National Observatory of Athens (Greece) and University of Southampton (United Kingdom)

MSC IN ASTRONOMY | STUDENT

2019-2020 | University of Granada (Spain)

BSC IN PHYSICS | STUDENT

2014 – 2019 | University of Salamanca (Spain)

INTERSHIPS

OMEGALAMBDATEC | DATA SCIENTIST

May 2022 – July 2022 | Garching, Munich (Germany)

- I participated in a tree classification project using satellite data. The aim of the project was to use machine learning to classify different tree species and use this information to quantify the carbon storage of the species. In particular, I developed a pipeline to download and pre-process data-images from Sentinel-2 satellite. I also helped preparing the data to train the model.

PREWARP | DATA SCIENTIST

January 2021 – March 2021 | On-line

- I participated in the development of an algorithm that optimises the prices of products in sales season to maximise the revenues. I developed part of the forecast model which is used afterwards to suggest the prices for the products to maximise the incomes.

INTERNATIONAL NETWORK & COLLABORATIONS

EUCLID | PHD STUDENT

2022-current

- Contribution to the characterisation of light cones for WG9.

BID4BEST | ESR

2020-current

- Early stage researcher of the H2020 Marie Skłodowska-Curie Innovative Training Network “Big Data analytics for Black hole Evolution Studies” (BiD4BEST, grant agreement No 860744).

CARMENES | MSc STUDENT

2020-current

- CARMENES is an experiment designed for the discovery of exoplanets in the habitable zone of M-dwarf stars using the radial velocity method based on optical and near-infrared spectroscopy. I studied the occurrence of exoplanet in CARMENCITA (CARMENES sample of M-dwarf stars) for my MSc thesis.

INTERNATIONAL CONFERENCES

- 2023/06/19-20 “A journey through galactic environments” in Porto Ercole, Italy (Poster)
- 2023/06/19-20 “CAVITY 3rd annual meeting” in Granada, Spain (contributed talk)
- 2023/01/30-02/01 “VI Meeting of AGN Research in Spain in the Era of the New Observatories” in Granada, Spain (contributed talk)
- 2022/09/28-29 “What Drives the Growth of Black Holes” in Reykjavík, Iceland (poster + spotlight talk)
- 2022/09/05-09 “XV Reunión científica de la Sociedad Española de Astronomía” in Tenerife, Spain (poster)
- 2022/07/16-24 “44th COSPAR Scientific assembly” in Athens, Greece, Symposium E1.7 “Properties and Evolution of Active Galactic Nuclei in Galaxy Clusters” (contributed talk)
- 2022/06/27-07/01 “European Astronomical Society annual meeting 2022” in Valencia, Spain, Session S5e: “Towards the next generation of X-ray surveys with Athena” (contributed talk)

INVITED TALKS & SEMINARS

- 2023/05/22 Joy of Hydrosims (USM/LMU, Munich)
- 2023/02/06 IAC AGN talks (IAC, Tenerife)
- 2023/02/02 Theoretical physics and astronomy group (UGR, Granada)
- 2022/11/25 FAME (INAF, Bologna)
- 2022/07/06 AGN coffee (ESO, Garching)
- 2022/06/21 ESO lunch talk (ESO, Garching)
- 2022/05/30 Southampton Monday Seminar (University of Southampton, Southampton)
- 2022/05/12 Kaffeerunde (MPE, Garching)

OUTREACH

- 2022-today Podcast “Pilgrims of the Kosmos”
- September 2022 Article in “Astronomia”
- July 2022 Hellenic astronomical society: HIPPARCHOS | Volume 3, Issue 5 pages 17-21 (co-author)
- Summer 2019-2021-2022 Support astronomer in Centro Astronomico de Tiedra

AWARDS & FUNDING

- 2020-today Ph.D. Marie Curie Research Fellow. Early Stage Researcher of the H2020 Marie Skłodowska-Curie Innovative Training Network “Big Data analytics for Black hole Evolution Studies” (BiD4BEST, grant agreement No 860744)

PUBLICATIONS

1. **Muñoz Rodríguez, I.**, Georgakakis, A., Shankar, F., et al. (in prep.). Radial distribution of Active Galactic Nuclei in massive clusters: Simulations versus observations.
2. **Muñoz Rodríguez, I.**, Georgakakis, A., Shankar, F., et al. (2023). Cosmic evolution of the incidence of Active Galactic Nuclei in massive clusters: Simulations versus observations. Monthly Notices of the Royal Astronomical Society, 518(1), 1041-1056.
3. Amado, P. J., Bauer, F. F., Rodríguez López, C., Rodríguez, E., Cardona Guillén, C., Perger, M., Caballero, J. A., López-González, M. J., **Muñoz Rodríguez, I.** et al., “The CARMENES search for exoplanets around M dwarfs. Two

terrestrial planets orbiting G 264-012 and one terrestrial planet orbiting Gl 393", *Astronomy and Astrophysics*, vol. 650, 2021. doi:10.1051/0004-6361/202140633.

4. Sabotta, S. Schlecker, M., Chaturvedi, P., Guenther, E. W., **Muñoz Rodríguez, I.** et al., "The CARMENES search for exoplanets around M dwarfs. Planet occurrence rates from a subsample of 71 stars", *Astronomy and Astrophysics*, vol. 653, 2021. doi:10.1051/0004-6361/202140968.