Ivan Esteban

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Research Focus: Neutrino and dark matter phenomenology in the laboratory, astrophysics, and cosmology

Professional Experience

CCAPP Postdoctoral Fellow, Ohio State University 2020 - Present

Education

PhD in Particle Physics, University of Barcelona 2020
Graded outstanding with honors (*Cum Laude*). International Doctorate
Extraordinary PhD Award

Master in Astrophysics, Particle Physics and Cosmology, University of Barcelona 2016
Graded outstanding with honors in my Master Thesis,
"Neutrino oscillations and CP violation: analysis of NOνA data"
Graduated with an average grade of 9.7/10.0

Bachelor's degree in Physics, University of the Basque Country 2015
Minor on Fundamental Physics
Graduated with excellence honors, with an average grade of 9.91/10.00

Publications (21 research papers, and 2969 citations according to iNSPIRE)

I. Esteban, A. H. G. Peter and S. Y. Kim, "Milky Way satellite velocities reveal the Dark Matter power spectrum at small scales", arXiv:2306.04674 [astro-ph.HE].

T. Bertólez-Martínez, C. A. Argüelles, I. Esteban, J. Lopez-Pavon, I. Martinez-Soler and J. Salvado, "IceCube and the origin of ANITA-IV events", arXiv:2305.03746 [astro-ph.HE].

D. Blas, I. Esteban, M. C. Gonzalez-Garcia and J. Salvado, "On neutrino-mediated potentials in a neutrino background", *JHEP* **04**, 039 (2023), arXiv:2212.03889 [hep-ph].

P.-W. Chang, I. Esteban, J. F. Beacom, T. A. Thompson and C. M. Hirata "Towards powerful probes of neutrino self-interactions in supernovae", arXiv:2206.12426 [hep-ph].

I. Esteban, S. Prohira and J. F. Beacom, "Detector Requirements for Model-Independent Measurements of Ultrahigh Energy Neutrino Cross Sections", *Phys. Rev. D* **106** (2022) no.2, 023021, arXiv:2205.09763 [hep-ph].

P. Coloma, I. Esteban, M. C. Gonzalez-Garcia, L. Larizgoitia, F. Monrabal and S. Palomares-Ruiz, "Bounds on new physics with data of the Dresden-II reactor experiment and COHERENT", *JHEP* **05** (2022), 037, arXiv:2202.10829 [hep-ph].

I. Esteban, O. Mena and J. Salvado, "Non-standard neutrino cosmology dilutes the lensing anomaly", *Phys. Rev. D* **106** (2022) no.8, 083516, arXiv:2202.04656 [astro-ph.CO].

C. A. Argüelles, I. Esteban, M. Hostert, K. J. Kelly, J. Kopp, P. A. N. Machado, I. Martinez-Soler and Y. F. Perez -Gonzalez, "MicroBooNE and the ν_e Interpretation of the MiniBooNE Low-Energy Excess", *Phys. Rev. Lett.*

128 (2022), 24, arXiv:2111.10359 [hep-ph]. The code was made public at github.com/Harvard-Neutrino/MicroBooNE-analysis-2021.

I. Esteban, S. Pandey, V. Brdar and J. F. Beacom, "Probing secret interactions of astrophysical neutrinos in the high-statistics era", *Phys. Rev. D* **104** (2021), 12, arXiv:2107.13568 [hep-ph]. The code was made public at github.com/ivan-esteban-phys/nuSIprop.

I. Esteban and J. Salvado, "Long Range Interactions in Cosmology: Implications for Neutrinos", *JCAP* **05** (2021), 036, arXiv:2101.05804 [hep-ph]. The code was made public at github.com/jsalvado/class_public_lrs.

I. Esteban, M. C. Gonzalez-Garcia, M. Maltoni, T. Schwetz and A. Zhou, "The fate of hints: updated global analysis of three-flavor neutrino oscillations", *JHEP* **09** (2020), 178, arXiv:2007.14792 [hep-ph].

P. Coloma, I. Esteban, M. C. Gonzalez-Garcia and J. Menendez, "Determining the nuclear neutron distribution from Coherent Elastic neutrino-Nucleus Scattering: current results and future prospects", *JHEP* **08** (2020), 030, arXiv:2006.08624 [hep-ph].

I. Esteban, M. C. Gonzalez-Garcia and M. Maltoni, "On the effect of NSI in the present determination of the mass ordering", arXiv:2004.04745 [hep-ph].

P. Coloma, I. Esteban, M. C. Gonzalez-Garcia and M. Maltoni, "Improved global fit to Non-Standard neutrino Interactions using COHERENT energy and timing data", *JHEP* **02** (2020), 023, arXiv:1911.09109 [hep-ph].

M. Dentler, I. Esteban, J. Kopp and P. Machado, "Decaying Sterile Neutrinos and the Short Baseline Oscillation Anomalies", *Phys. Rev. D* **101** (2020) no.11, 115013, arXiv:1911.01427 [hep-ph].

D. Baxter, J.I. Collar, P. Coloma, C.E. Dahl, I. Esteban, P. Ferrario, J.J. Gomez-Cadenas, M.C. Gonzalez-Garcia, A.R.L. Kavner, C.M. Lewis, F. Monrabal, J. Muñoz Vidal, P. Privitera, K. Ramanathan and J. Renner, "Coherent Elastic Neutrino-Nucleus Scattering at the European Spallation Source", *JHEP* **02** (2020) 123, arXiv:1911.00762 [physics.ins-det].

I. Esteban, J. Lopez-Pavon, I. Martinez-Soler and J. Salvado, "Looking at the axionic dark sector with ANITA", *Eur. Phys. J. C* **80** (2020) no.3, 259, arXiv:1905.10372 [hep-ph].

I. Esteban, M. C. Gonzalez-Garcia and M. Maltoni, "On the Determination of Leptonic CP Violation and Neutrino Mass Ordering in Presence of Non-Standard Interactions: Present Status", *JHEP* **1906** (2019) 055, arXiv:1905.05203 [hep-ph].

I. Esteban, M. C. Gonzalez-Garcia, A. Hernandez-Cabezudo, M. Maltoni and T. Schwetz, "Global analysis of three-flavour neutrino oscillations: synergies and tensions in the determination of θ_{23}, δ_{CP}, and the mass ordering", *JHEP* **01** (2019) 106, arXiv:1811.05487 [hep-ph].

I. Esteban, M. C. Gonzalez-Garcia, M. Maltoni, I. Martinez-Soler, and J. Salvado, "Updated Constraints on Non-Standard Interactions from Global Analysis of Oscillation Data", *JHEP* **08** (2018) 180, arXiv:1805.04530 [hep-ph].

I. Esteban, M. C. Gonzalez-Garcia, M. Maltoni, I. Martinez-Soler, and T. Schwetz, "Updated fit to three neutrino mixing: exploring the accelerator-reactor complementarity", *JHEP* **01** (2017) 087, arXiv:1611.01514 [hep-ph].

R. Alves Batista *et al.* "EuCAPT White Paper: Opportunities and Challenges for Theoretical Astroparticle Physics in the Next Decade", arXiv:2110.10074 [astro-ph.HE].

J. M. Berryman *et al.* "Neutrino Self-Interactions: A White Paper", arXiv:2203.01955 [hep-ph].

C. A. Argüelles *et al.* "Snowmass White Paper: Beyond the Standard Model effects on Neutrino Flavor", *Eur. Phys. J. C* **83** (2023) no.1, 15, arXiv:2203.10811 [hep-ph].

H. Abele *et al.* "Particle Physics at the European Spallation Source", arXiv:2211.10396 [physics.ins-det].

Selected conference talks and posters (Presented 26 talks and 6 posters, not all shown here)

"Neutrino self-interactions: towards strong probes from supernovae." Talk presented at the *2023 Neutrino Platform Week*, CERN, 2023.

"Gravitational CMB lensing illuminates neutrino interactions." Poster presented at the *Neutrino22 Conference*. Prize for the best cosmology poster, and selected among the overall top 6 posters.

"Ultra-high energy neutrinos and physics opportunities." Invited talk presented at the *Neutrino Theories (NuTs) Extended Workshop*, Madrid 2022.

"Long-range neutrino interactions and cosmology." Invited plenary talk at the *Neutrino Cosmology Day*, Munich 2022.

"Coherent neutrino scattering: a window into neutron distributions." Invited talk presented at the *Neutrino- Nucleus Interactions in the Standard Model and Beyond,* virtual CERN 2022.

"Astrophysical neutrino self-interactions in the high-statistics era." Selected hot topic talk at *TAUP 2021*.

"Astrophysical neutrino self-interactions in the high-statistics era." Talk presented at the *2021 Division of Particles and Fields APS meeting*.

"Exploring neutrino long range interactions from the cosmos." Talk presented at *Pheno 2021*.

"Precision measurements in neutrino experiments." Invited plenary talk at the *First EuCAPT Annual Symposium*, 2021.

"European Spallation Source: the future of Coherent Neutrino Scattering." Invited talk presented at the young scientist forum of *2021 Rencontres de Moriond*.

"COHERENT neutrinos, today and tomorrow." Poster and talk presented at *NuPhys 2019*.

"Light sterile neutrinos: an overview." Invited plenary talk given at the *nuSTORM Workshop*, CERN, 2019.

"MiniBooNE low-energy excess as a hint for neutrino decay." Invited talk given at the *2019 Neutrino Platform Week: Hot Topics in Neutrino Physics*, CERN, 2019.

"Can axion-like particles explain the anomalous ANITA events?." Poster and talk presented at the *Invisibles 19 School and Workshop*. Prize for the best poster.

"Global Analysis of Neutrino Oscillation Data Circa Autumn 2018." Invited talk given at the *NuTheories workshop*, Pittsburgh, 2018.

"Light sterile neutrinos: a critical overview." Invited plenary talk given at the *15th International Workshop on Tau Lepton Physics*, 2018.

"Global Analysis of Neutrino Oscillation Data Circa Autumn 2017." Talk given at the *IX CPAN Days*, Santander, 2017.

Invited seminars (Invited to 16 seminars)

"Neutrino secret interactions from outer space." *Johns Hopkins University*, May 2023.

"Neutrino secret interactions from outer space." *Texas A&M University*, April 2023.

"Neutrino secret interactions from outer space." *Instituto de Astrofisica de Canarias*, March 2023.

"Ultra-high energy neutrinos and physics opportunities."*Queen Mary University*, February 2023.

"Ultra-high energy neutrinos and physics opportunities." *University of Barcelona*, January 2023.

"Neutrino secret interactions from outer space." *Niels Bohr Institute*, December 2022.

"Ultra-high energy neutrinos and physics opportunities." *Kansas University*, September 2022.

"Ultra-High Energy Astrophysical Neutrinos: A New Window to the Universe." *Technical University of Munich*, May 2022.

"Sterile neutrinos in 2021, why should we care?." *Institut de Fisica Corpuscular (Valencia)*, December 2021.

"Neutrino interactions from the Cosmos." *New Mexico University*, October 2021.

"Neutrino interactions from the Cosmos." *Fermilab theory division*, October 2021.

"Neutrino interactions from the Cosmos." *University of Cincinnati*, October 2021.

"Long Range Interactions in Cosmology: Implications for Neutrinos."*Northwestern University*, April 2021.

"Phenomenology of coherent neutrinos, today and tomorrow." *Fermilab*, March 2021.

"Long Range Interactions in Cosmology: Implications for Neutrinos." *Campinas University*, March 2021.

"Long Range Interactions in Cosmology: Implications for Neutrinos." *Technical University of Munich*, February 2021.

Service

Referee for Journal of Cosmology and Astroparticle Physics *(JCAP)*	2022 - Present
Referee for Physical Review Letters *(PRL)*	2020 - Present
Referee for Computer Physics Communications	2020 - Present
Referee for Physical Review D *(PRD)*	2019 - Present
Referee for The European Physical Journal C *(EPJ C)*	2019 - Present
Referee for Journal of High Energy Physics *(JHEP)*	2017 - Present
Reviewer of the DOE Office of Science Graduate Student Research Program Reviewed 2 applications to pursue a PhD thesis project at a DOE national laboratory.	2022
Co-organizer of the weekly CCAPP Astroparticle Physics journal club	2021 - Present
Member of the UB Physics Faculty Council Student Representative in the Academic, Research, Doctorate and Equality Commissions of the Physics Faculty in the University of Barcelona.	2016 - 2018
Organizer of the "Encontres amb el Tercer Cicle" Organized four outreach lecture cycles given by PhD students, attended by about 100 people each.	2017 - 2020
Member of the Local Organizing Committee in the 4th Workshop on the QCD Structure of the Nucleon (Bilbao)	2016
Member of the UPV/EHU Science and Technology Student Council Counseled students on their relation with the University. Part of the Faculty Council.	2013 - 2015
President of Zimatek, the Basque association of Physics and Electronic Engineering students Organized three lecture cycles attended by about 100 people each. Coordinated various trips of about 50 students to different research facilities.	2013 - 2015

Awards and fellowships

UNIBASQ accreditation for Associate Professor (*Profesor Adjunto*)

Obtained the prize for the best cosmology poster in the Neutrino22 Conference, together with being selected among the overall top 6 posters

Obtained a CCAPP Fellowship to carry out independent research at the Center for Cosmology and Astroparticle Physics at the Ohio State University

On top of attaining the Extraordinary PhD Award of the Faculty of Physics (University of Barcelona),

elected as one of the 10 finalists in the "Claustre de Doctors de la Universitat de Barcelona" prize for the best PhD thesis in the University of Barcelona.

Obtained the first prize for the best scientific poster in the Invisibles 19 School

Obtained an FPU Award to carry out a 3-month research stay in a foreign institution. Visited the Johannes Gutenberg-Universität Mainz

Attained the 2016 Outstanding Award of the Master in Astrophysics, Particle Physics and Cosmology in the University of Barcelona

Obtained an FPU PhD Fellowship, awarded by the Spanish Ministry of Education

Selected for a La Caixa PhD Fellowship (declined in favour of an FPU Fellowship)

Attained the 2014/2015 Spanish National Graduate Award (*Premio Nacional Fin de Carrera*)

Attained the 2015 Outstanding Physics Graduate Award in the University of the Basque Country

Beneficiary of the 2015-2016 Catalunya La Pedrera Foundation Excellence Master Grant

Obtained the best average grade of all Physics students in 2015 at the University of the Basque Country

Selected for the 2015 Bizkaia Talentia Programme, a programme targeted at the students with the highest potential at the three Basque universities

Selected for the first International Mentorship Program of ECUSA, the association of Spanish scientists in the USA, during the 2014/2015 academic year

Beneficiary of the Universitary Academic Excellence Grant of the Basque Government (2011-2012)

Teaching and mentoring

Local host of the visiting PhD Student Rasmi Hajjar at The Ohio State University	2023
Delivered the "Neutrinos" tutorial at the Invisibles21 School	2021
Bloom Carroll Local Science Fair Tutored a high school student in her Science Fair project. Evaluated other projects.	2020
Tutorial Assistant in "Statistics and introduction to Machine Learning", "Neutrino Phenomenology" and "Neutrinos in Cosmology" during the Invisibles19 School	2019
One Variable Calculus (Universitat de Barcelona) Taught 120 hours to first-year Physics undergraduate students.	2017 - 2020
Tutor at undergraduate level Tutored Physics undergraduate students.	2014 - 2015

Outreach

"Neutrinos: shedding light on the secrets of antimatter" Article in the Basque *Elhuyar* magazine. Available at this URL.	2021
"Neutrinos in the South Pole" Interview in the public Basque radio station. Available at this URL.	2021
Physics Faculty Open Doors and Particle Physics Workshop Collaborated in whole-day outreach activities targeted at high-school students.	2019, 2020
"Neutrinos: seeing the invisible" Talk given to the general public as part of the *European Researchers Night*.	2019
"Neutrinos: seeing the invisible" Talk given to the general public as part of the *Pint of Science* program.	2019

"Neutrino oscillations: in the frontier of the Standard Model" Talk given to physics undergraduate students at the University of Barcelona.	2018
Member of the outreach association Quadrivium Gave two 1-hour talks about General Relativity in Barcelona's community centers.	2018
Participation in the 2012 Bilbao Science Week Part of the UPV/EHU Physics Stand.	2012

Undergraduate research experience

Deutsches Elektronen-Synchrotron (DESY), summer student Participated in the DESY-CMS group evaluating the topology of boosted Higgs boson production along with top quarks. Conducted the analysis for that process with the first data collected in the LHC at a center-of-mass energies of 13 TeV.	2015
Brookhaven National Laboratory, summer stay Collaborated with the eRHIC group on simulation data analysis for comparing calorimetry techniques. Assisted the STAR experiment in upgrading the Forward Meson Spectrometer.	2014

Participation in research projects

New Frontiers in Nuclear Astrophysics. National Science Foundation PHY-2012955	2020 – Present
Maria de Maeztu Excellence Distinction. CEX2019-000918-M	2020
Teoría y Fenomenología de las Interacciones Fundamentales: física de partículas y unificación de las fuerzas. Spanish Government PID2019-105614GB-C21	2020
Grup de Física Teòrica d'Altes Energies. Government of Catalonia 2017SGR929	2017 – 2020
The Elusives Enterprise: Asymmetries of the Invisible Universe. European Commission H2020-MSCA-ITN-2015-674896	2016 – 2020
InvisiblesPlus. European Commission H2020-MSCA-RISE-2015-690575	2016 – 2020
Teoría y Fenomenología de las Interacciones Fundamentales: física de partículas y unificación de las fuerzas. Spanish Government FPA2016-76005-C2-1-P	2016 – 2020
Teoría y Fenomenología de las Interacciones Fundamentales: física de partículas y unificación de las fuerzas. Spanish Government FPA2013-4657-C2-1-P	2016

Skills

LANGUAGES

English: Fluent, level C2 (Certificate of Proficiency in English)
Spanish: Mother tongue
Basque: Fluent, level C1 (Euskararen Gaitasun Agiria)
Catalan: Basic understanding

COMPUTER SKILLS

Python, C++
MultiNest
Linux
LaTeX
Basic knowledge of ROOT, Java and FORTRAN