

c v n CURRÍCULUM VITAE NORMALIZADO



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General quality indicators of scientific research

This section describes briefly the main quality indicators of scientific production (periods of research activity, experience in supervising doctoral theses, total citations, articles in journals of the first quartile, H index...). It also includes other important aspects or peculiarities.

- Total number of papers: 15, (all of them in Q1 journals); 2 in Phys. Rev. Letters.
- Total number of citations: 852 (Inspire-HEP); 7 with more than 50 cites.
- h-factor: 14 (Inspire-HEP).

**Current professional situation****Employing entity:** Universidad del País Vasco **Type of entity:** University**Department:** Física, Facultad de Ciencia y Tecnología**Professional category:** Associate Professor**Start date:** 08/07/2022**Type of contract:** Permanent employment contract**Performed tasks:** - Electromagnetism (Physics) - Mathematical Methods (Physics) - Physics (Biology) - Fields & Particles (Master in Quantum Science and Technology)**Previous positions and activities**

	Employing entity	Professional category	Start date
1	Universidad del País Vasco	Assistant Professor	28/02/2018
2	Universidad del País Vasco	Profesor Laboral Interino	19/09/2017
3	Universidad del País Vasco	Proferos Laboral Interino	07/02/2017
4	Universidad del País Vasco	Investigador Doctor Reciente	07/04/2016
5	Universidad del País Vasco	Investigador predoctoral	01/02/2012

1 **Employing entity:** Universidad del País Vasco **Type of entity:** University**Department:** Física, Facultad de Ciencia y Tecnología**Professional category:** Assistant Professor**Start-End date:** 28/02/2018 - 07/07/2022**Type of contract:** Temporary**2** **Employing entity:** Universidad del País Vasco **Type of entity:** University**Professional category:** Profesor Laboral Interino**Start-End date:** 19/09/2017 - 27/02/2018**Duration:** 5 months - 8 days**3** **Employing entity:** Universidad del País Vasco **Type of entity:** University**Professional category:** Proferos Laboral Interino**Start-End date:** 07/02/2017 - 31/07/2017**Duration:** 5 months - 23 days**Performed tasks:** Profesor: - Cálculo (Grado en Ingeniería Industrial) - Métodos estadísticos para ingenieros (Grado en Ingeniería Eléctrica)**4** **Employing entity:** Universidad del País Vasco **Type of entity:** University**Professional category:** Investigador Doctor Reciente**Start-End date:** 07/04/2016 - 06/01/2017**Duration:** 9 months



5 **Employing entity:** Universidad del País Vasco **Type of entity:** University
Professional category: Investigador predoctoral
Start-End date: 01/02/2012 - 31/01/2016 **Duration:** 4 years



Education

University education

1st and 2nd cycle studies and pre-Bologna degrees

1 **University degree:** Máster Oficial

Name of qualification: MsC in Teacher Training for Compulsory Secondary Education, Upper Secondary Education, Vocational Training and Foreign Language Teaching

Degree awarding entity: Universidad del País Vasco **Type of entity:** University

Date of qualification: 04/07/2017

2 **University degree:** Máster Oficial

Name of qualification: MsC in Quantum Science and Technology

Degree awarding entity: Universidad del País Vasco **Type of entity:** University

Date of qualification: 18/10/2012

3 **University degree:** Higher degree

Name of qualification: BsC in Physics

Degree awarding entity: Universidad del País Vasco **Type of entity:** University

Date of qualification: 21/09/2011

Doctorates

Doctorate programme: PhD in Quantum Science and Technology

Degree awarding entity: Universidad del País Vasco **Type of entity:** University

Date of degree: 29/02/2016

Language skills

Language	Listening skills	Reading skills	Spoken interaction	Speaking skills	Writing skills
English	C1	C1	C1	C1	C1
Basque	C2	C2	C2	C2	C2

Teaching experience



Experience supervising doctoral thesis and/or final year projects

- 1** **Project title:** Mikrouhinen hondo kosmikoaren fisika
Entity: Universidad del País Vasco **Type of entity:** University
Student: Aitor Larrañaga Jaio
Date of reading: 14/07/2022
- 2** **Project title:** Neutrinoak Kosmologian. Neutrinoen inguruko azterketa kosmologiaren ikuspuntutik.
Entity: Universidad del País Vasco **Type of entity:** University
Student: Asier Mongelos Martinez
Date of reading: 14/07/2022
- 3** **Project title:** Unibertso azeleratua: ebidentziak eta eredu posibleak
Entity: Universidad del País Vasco **Type of entity:** University
Student: Mainer Gonzalez Bañuelos
Date of reading: 14/07/2022
- 4** **Project title:** Lehen izar generaziotik eratorritako zulo beltzen jaiotza eta hazte-prozesua
Entity: Universidad del País Vasco **Type of entity:** University
Student: Jon Izaga Aguirre
Date of reading: 13/07/2022
- 5** **Project title:** Uhin grabitatorio kosmologikoak
Entity: Universidad del País Vasco **Type of entity:** University
Student: Aitor Ruiz de Austri Izagirre
Date of reading: 09/07/2021
- 6** **Project title:** Inflazio kosmikoa. Inflazioaren teoria eta kontrako alternatibak
Entity: Universidad del País Vasco **Type of entity:** University
Student: Asier Agirre Olaeta
Date of reading: 08/07/2021
- 7** **Project title:** Chern-Simons vortices: a systematic study
Type of project: Master Thesis
Entity: Universidad del País Vasco **Type of entity:** University
Student: Asier Izquierdo
Obtained qualification: 9
Date of reading: 24/09/2020
- 8** **Project title:** Cosmic string loop decay in Abelian Higgs field theory simulations
Type of project: Master thesis
Entity: Universidad del País Vasco **Type of entity:** University
Student: Ander Urio
Obtained qualification: 9
Date of reading: 24/09/2020
- 9** **Project title:** Hubble-en konstantearen misterioa. Zuzeneko eta zeharkako behaketen bateraezintasunaren azterketa
Type of project: Bachelor Project



Entity: Universidad del País Vasco
Student: Iker Elortegi Garcia
Obtained qualification: 9.5
Date of reading: 13/07/2020

Type of entity: University

- 10** **Project title:** Inflazio kosmikoa. Inflazioaren teoria eta fluktuazio kuantikoak honen garapenean
Type of project: Bachelor project
Entity: Universidad del País Vasco
Student: Ander Urio Garmendia
Obtained qualification: 9
Date of reading: 11/07/2019

Type of entity: University

Scientific and technological experience

Scientific or technological activities

R&D projects funded through competitive calls of public or private entities

- 1** **Name of the project:** Early Universe, cosmology and fundamental Physics
Entity where project took place: Universidad del País Vasco
City of entity: Bilbao, Basque Country, Spain
Name principal investigator (PI, Co-PI....): José Juan Blanco Pillado
Start-End date: 01/09/2022 - 31/08/2026
Total amount: 257.730 €
Type of entity: University
- 2** **Name of the project:** Gravitation, Cosmology and Fundamental Physics
Entity where project took place: Universidad del País Vasco
City of entity: Bilbao, Basque Country, Spain
Name principal investigator (PI, Co-PI....): Jon Urrestilla Urizabal; Ruth Lazkoz
Funding entity or bodies: Gobierno Vasco
City funding entity: Spain
Start-End date: 01/01/2022 - 31/12/2025
Total amount: 534.030 €
Dedication regime: Full time
Type of entity: Gobierno Autónomico
Duration: 4 years
- 3** **Name of the project:** Early Universe Cosmology and High Energy Physics
Entity where project took place: Universidad del País Vasco
City of entity: Bilbao, Basque Country, Spain
Name principal investigator (PI, Co-PI....): José Juan Blanco Pillado
Start-End date: 01/01/2019 - 31/12/2021
Total amount: 124.630 €
Type of entity: University



- 4** **Name of the project:** Early Universe and Fundamental Physics
Entity where project took place: Universidad del País Vasco **Type of entity:** University
City of entity: Bilbao, Basque Country, Spain
Name principal investigator (PI, Co-PI....): Jon Urrestilla Urizabal
Funding entity or bodies: Gobierno Vasco **Type of entity:** Gobierno Autónomico
City funding entity: Spain
Start-End date: 01/01/2016 - 31/12/2021 **Duration:** 6 years
Total amount: 412.526 €
Dedication regime: Full time
- 5** **Name of the project:** Early Universe Cosmology Probes to High Energy Physics and Quantum Field Theory Methods
Entity where project took place: Universidad del País Vasco **Type of entity:** University
City of entity: Bilbao, Basque Country, Spain
Name principal investigator (PI, Co-PI....): Jose Juan Blanco Pillado
Start-End date: 01/01/2016 - 31/12/2018 **Duration:** 3 years
Total amount: 44.100 €
Dedication regime: Full time
- 6** **Name of the project:** Exploring the Physics of Inflation
Type of project: Basic research (including archaeological digs, etc)
Entity where project took place: Universidad del País Vasco **Type of entity:** University
City of entity: Bilbao, Basque Country, Spain
Name principal investigator (PI, Co-PI....): Enrique Martínez González
Funding entity or bodies: Ministerio de Economía y Competitividad **Type of entity:** State agency
City funding entity: Spain
Start-End date: 27/12/2010 - 26/06/2017 **Duration:** 6 years - 6 months
Total amount: 4.000.000 €
Dedication regime: Full time
- 7** **Name of the project:** Métodos no perturbativos en Teoría Cuántica de Campos y aplicaciones
Entity where project took place: Universidad del País Vasco **Type of entity:** University
City of entity: Bilbao, Basque Country, Spain
Name principal investigator (PI, Co-PI....): Juan Luis Mañes Palacios
Funding entity or bodies: Ministerio de Economía y Competitividad **Type of entity:** State agency
City funding entity: Spain
Start-End date: 01/02/2012 - 31/12/2015 **Duration:** 3 years
Total amount: 44.694 €
Dedication regime: Full time



- 8** **Name of the project:** Física teórica: Teoría de Campos
Type of project: Basic research (including archaeological digs, etc)
Entity where project took place: Universidad del País Vasco **Type of entity:** University
City of entity: Bilbao, Basque Country, Spain
Name principal investigator (PI, Co-PI...): Iñigo Luis Egusquiza Egusquiza
Funding entity or bodies:
 Gobierno Vasco **Type of entity:** Gobierno Autónomico
City funding entity: Spain
Start-End date: 01/01/2010 - 31/12/2015 **Duration:** 6 years
Total amount: 35.000 €
Dedication regime: Full time
- 9** **Name of the project:** La interacción entre las cuerdas cósmicas, las ondas gravitatorias y el CMB
Entity where project took place: Universidad del País Vasco **Type of entity:** University
City of entity: Bilbao, Basque Country, Spain
Name principal investigator (PI, Co-PI...): Jon Urrestilla Urizabal
Start-End date: 22/11/2012 - 21/11/2014 **Duration:** 2 years
Total amount: 7.360 €
Dedication regime: Full time

Scientific and technological activities

Scientific production

Publications, scientific and technical documents

- 1** Mark Hindmarsh; Joanes Lizarraga; Asier Lopez-Eiguren; Jon Urrestilla. Approach to scaling in axion string networks. Phys. Rev. D. 103 - 10, pp. 103534 - 103534. 2021.
Type of production: Scientific paper **Format:** Journal
- 2** Mark Hindmarsh; Joanes Lizarraga; Ander Urio; Jon Urrestilla. Loop decay in Abelian-Higgs string networks. Phys. Rev. D. 103 - 10, pp. 043519 - 043519. 2021.
Type of production: Scientific paper **Format:** Journal
- 3** Daniel G. Figueroa; Mark Hindmarsh; Joanes Lizarraga; Jon Urrestilla. Irreducible background of gravitational waves from a cosmic defect network: update and comparison of numerical techniques. Phys. Rev. D. 102 - 10, pp. 103516 - 103516. 2020.
Type of production: Scientific paper **Format:** Journal
- 4** Mark Hindmarsh; Joanes Lizarraga; Asier Lopez-Eiguren; Jon Urrestilla. Scaling Density of Axion Strings. Phys. Rev. Lett. 124 - 2, pp. 021301 - 021301. 2020.
Type of production: Scientific paper **Format:** Journal
Position of signature: 2
Total no. authors: 4 **Corresponding author:** Yes

- 5 Mark Hindmarsh; Joanes Lizarraga; Jon Urrestilla; David Daverio; Martin Kunz. Type I Abelian Higgs strings: evolution and Cosmic Microwave Background constraints. Physical Review D. D99 - 8, pp. 083522 - 083522. 29/04/2019.

Type of production: Scientific paper

Format: Journal

Corresponding author: Yes

- 6 Exploring cosmic origins with CORE: Inflation. Journal of Cosmology and Astroparticle Physics. 05/04/2018.

Type of production: Scientific paper

- 7 Exploring cosmic origins with CORE: Survey requirements and mission design. Journal of Cosmology and Astroparticle Physics. 05/04/2018.

Type of production: Scientific paper

- 8 Mark Hindmarsh; Joanes Lizarraga; Jon Urrestilla; David Daverio; Martin Kunz. Scaling from gauge and scalar radiation in Abelian Higgs string networks. Physical Review D. 96 - 023525, American Physical Society, 21/07/2017. Available on-line at: <<https://journals.aps.org/prd/abstract/10.1103/PhysRevD.96.023525>>.

Type of production: Scientific paper

Format: Journal

Position of signature: 2

Degree of contribution: Author or co-author of article in journal with external admissions assessment committee

Corresponding author: Yes

Total no. authors: 5

Relevant results: We investigate cosmic string networks in the Abelian Higgs model using data from a campaign of large-scale numerical simulations on lattices of up to 40963 grid points. We observe scaling or self-similarity of the networks over a wide range of scales and estimate the asymptotic values of the mean string separation in horizon length units ℓ and of the mean square string velocity \bar{v}^2 in the continuum and large time limits. The scaling occurs because the strings lose energy into classical radiation of the scalar and gauge fields of the Abelian Higgs model. We quantify the energy loss with a dimensionless radiative efficiency parameter and show that it does not vary significantly with lattice spacing or string separation. This implies that the radiative energy loss underlying the scaling behavior is not a lattice artifact, and justifies the extrapolation of measured network properties to large times for computations of cosmological perturbations. We also show that the core growth method, which increases the defect core width with time to extend the dynamic range of simulations, does not introduce significant systematic error. We compare ℓ and \bar{v}^2 to values measured in simulations using the Nambu-Goto approximation, finding that the latter underestimate the mean string separation by about 25%, and overestimate \bar{v}^2 by about 10%. The scaling of the string separation implies that string loops decay by the emission of massive radiation within a Hubble time in field theory simulations, in contrast to the Nambu-Goto scenario which neglects this energy loss mechanism. String loops surviving for only one Hubble time emit much less gravitational radiation than in the Nambu-Goto scenario and are consequently subject to much weaker gravitational wave constraints on their tension.

- 9 Asier Lopez Eiguren; Joanes Lizarraga; Mark Hindmarsh; Jon Urrestilla. Cosmic microwave background constraints for global strings and global monopoles. Journal of Cosmology and Astroparticle Physics. 1707 - 026, IOP Publishing, 14/07/2017. Available on-line at: <<http://iopscience.iop.org/article/10.1088/1475-7516/2017/07/026/meta>>.

Type of production: Scientific paper

Format: Journal

Position of signature: 2

Degree of contribution: Author or co-author of article in journal with external admissions assessment committee

Total no. authors: 4

Relevant results: We present the first cosmic microwave background (CMB) power spectra from numerical simulations of the global $O(N)$ linear λ -model, with $N=2,3$, which have global strings and monopoles as topological defects. In order to compute the CMB power spectra we compute the unequal time correlators (UETCs) of the energy-momentum tensor, showing that they fall off at high wave number faster than naive estimates based on the geometry of the defects, indicating non-trivial (anti-)correlations between the defects and the surrounding Goldstone boson field. We obtain source functions for Einstein-Boltzmann solvers from the UETCs, using a recently developed method that improves the modelling at the radiation-matter transition. We show that the interpolation function that mimics the transition is similar to other defect models, but not identical, confirming the

non-universality of the interpolation function. The CMB power spectra for global strings and global monopoles have the same overall shape as those obtained using the non-linear Λ -model approximation, which is well captured by a large- N calculation. However, the amplitudes are larger than the large- N calculation would naively predict, and in the case of global strings much larger: a factor of 20 at the peak. Finally we compare the CMB power spectra with the latest CMB data in order to put limits on the allowed contribution to the temperature power spectrum at multipole $l = 10$ of 1.7% for global strings and 2.4% for global monopoles. These limits correspond to symmetry-breaking scales of 2.9×10^{15} GeV (6.3×10^{14} GeV with the expected logarithmic scaling of the effective string tension between the simulation time and decoupling) and 6.4×10^{15} GeV respectively. The bound on global strings is a significant one for the ultra-light axion scenario with axion masses $m_a \lesssim 10^{28}$ eV. These upper limits indicate that gravitational waves from global topological defects will not be observable at the gravitational wave observatory LISA.

- 10** Joanes Lizarraga; Jon Urrestilla; David Daverio; Mark Hindmarsh; Martin Kunz. New CMB constraints for Abelian Higgs cosmic strings. *Journal of Cosmology and Astroparticle Physics*. 1610 - 042, IOP Publishing, 24/10/2016. Available on-line at: <http://iopscience.iop.org/article/10.1088/1475-7516/2016/10/042/meta>.

Type of production: Scientific paper

Format: Journal

Position of signature: 1

Degree of contribution: Author or co-author of article in journal with external admissions assessment committee

Total no. authors: 5

Corresponding author: Yes

Relevant results: We present cosmic microwave background (CMB) power spectra from recent numerical simulations of cosmic strings in the Abelian Higgs model and compare them to CMB power spectra measured by Planck. We obtain revised constraints on the cosmic string tension parameter $G\mu$. For example, in the Λ CDM model with the addition of strings and no primordial tensor perturbations, we find $G\mu < 2.0 \times 10^{-7}$ at 95% confidence, about 20% lower than the value obtained from previous simulations, which had 1/64 of the spatial volume. We investigate the source of the difference, showing that the main cause is an improved treatment of the string evolution across the radiation-matter transition. The increased computational volume also makes possible to simulate fully the physical equations of motion, in which the string cores shrink in comoving coordinates. This, and the larger dynamic range, changes the amplitude of the power spectra by only about 10%, demonstrating that field theory simulations of cosmic strings have now reached the required dynamic range for CMB

- 11** Joanes Lizarraga; Jon Urrestilla. Survival of pq-superstrings in field theory simulations. *Journal of Cosmology and Astroparticle Physics*. 1604 - 053, IOP Publishing, 27/04/2016. Available on-line at: <http://iopscience.iop.org/article/10.1088/1475-7516/2016/04/053/meta>.

Type of production: Scientific paper

Format: Journal

Position of signature: 1

Degree of contribution: Author or co-author of article in journal with external admissions assessment committee

Total no. authors: 2

Corresponding author: Yes

Relevant results: We perform large-scale field theoretical simulations in expanding universe to characterize a network of strings that can form composed bound states. The network consists of two copies of Abelian Higgs strings (which we label p and q , respectively) coupled via a potential term to give pq bound states. The simulations are performed using two different kinds of initial conditions: the first one with a network of p - and q -strings, and the second one with a network of q - and pq -strings. This way, we start from two opposite situations: one with no initial pq -strings, and one with a large initial number of pq -strings. We find that in both cases the system scales, and in both cases the system prefers to have a low fraction of pq -strings. This is somewhat surprising in the case for the second type of conditions, showing that the unzipping mechanism is very efficient. We also find hints that both initial conditions tend to asymptote to a common configuration, though we would need a larger dynamical range to confirm it. The average velocities of the different types of strings in the network have also been explored for the first

- 12** David Daverio; Mark Hindmarsh; Martin Kunz; Joanes Lizarraga; Jon Urrestilla. Energy-momentum correlations for Abelian Higgs cosmic strings. *Physical Review D*. 93 - 085014, American Physical Society, 12/04/2016. Available on-line at: <https://journals.aps.org/prd/abstract/10.1103/PhysRevD.93.085014>.

Type of production: Scientific paper

Format: Journal

Position of signature: 4

Degree of contribution: Author or co-author of article in journal with external admissions assessment committee



Total no. authors: 5

Relevant results: We report on the energy-momentum correlators obtained with recent numerical simulations of the Abelian Higgs model, essential for the computation of cosmic microwave background and matter perturbations of cosmic strings. Due to significant improvements both in raw computing power and in our parallel simulation framework, the dynamical range of the simulations has increased fourfold both in space and time, and for the first time we are able to simulate strings with a constant physical width in both the radiation and matter eras. The new simulations improve the accuracy of the measurements of the correlation functions at the horizon scale and confirm the shape around the peak. The normalization is slightly higher in the high wave-number tails, due to a small increase in the string density. We study, for the first time, the behavior of the correlators across cosmological transitions and discover that the correlation functions evolve adiabatically; i.e., the network adapts quickly to changes in the expansion rate. We propose a new method for constructing source functions for Einstein-Boltzmann integrators, comparing it with two other methods previously used. The new method is more consistent, easier to implement, and significantly more

- 13** Joanes Lizarraga; Jon Urrestilla; David Daverio; Mark Hindmarsh; Martin Kunz; Andrew R. Liddle. Constraining topological defects with temperature and polarization anisotropies. Physical Review D. 90 - 103504, American Physical Society, 03/11/2014. Available on-line at: <<https://journals.aps.org/prd/abstract/10.1103/PhysRevD.90.103504>>.

Type of production: Scientific paper

Format: Journal

Position of signature: 1

Degree of contribution: Author or co-author of article in journal with external admissions assessment committee

Total no. authors: 6

Relevant results: We analyze the possible contribution of topological defects to cosmic microwave anisotropies, both temperature and polarization. We allow for the presence of both inflationary scalars and tensors, and of polarized dust foregrounds that may contribute to or dominate the B-mode polarization signal. We confirm and quantify our previous statements that topological defects on their own are a poor fit to the B-mode signal. However, adding topological defects to a model with a tensor component or a dust component improves the fit around $\frac{\Delta C_{\ell}^{\text{B}}}{C_{\ell}^{\text{B}}} \approx 200$. Fitting simultaneously to both temperature and polarization data, we find that textures fit almost as well as tensors ($\frac{\Delta C_{\ell}^{\text{B}}}{C_{\ell}^{\text{B}}} \approx 2.0$), while Abelian Higgs strings are ruled out as the sole source of the B-mode signal at low ℓ . The 95% confidence upper limits on models combining defects and dust are $G < 2.7$ (Abelian Higgs strings), $G < 9.8$ (semilocal strings) and $G < 7.3$ (textures), a small reduction on the Planck bounds. The most economical fit overall is obtained by the standard Λ -cold dark matter model with a polarized dust

- 14** Joanes Lizarraga; Jon Urrestilla; David Daverio; Mark Hindmarsh; Martin Kunz; Andrew R. Liddle. Can topological defects mimic the BICEP2 B-mode signal?. Physical Review Letters. 112 - 171301, American Physical Society, 29/04/2014. Available on-line at: <<https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.112.171301>>.

Type of production: Scientific paper

Format: Journal

Position of signature: 1

Degree of contribution: Author or co-author of article in journal with external admissions assessment committee

Total no. authors: 6

Relevant results: We show that the B-mode polarization signal detected at low multipoles by BICEP2 cannot be entirely due to topological defects. This would be incompatible with the high-multipole B-mode polarization data and also with existing temperature anisotropy data. Adding cosmic strings to a model with tensors, we find that B-modes on their own provide a comparable limit on the defects to that already coming from Planck satellite temperature data. We note that strings at this limit give a modest improvement to the best-fit of the B-mode data, at a somewhat lower tensor-to-scalar ratio of $r \approx 0.001$

- 15** Joanes Lizarraga; Irene Sendra; Jon Urrestilla. Correlations between cosmic strings and extra relativistic species. Physical Review D. 86 - 123014, American Physical Society, 19/12/2012. Available on-line at: <https://journals.aps.org/prd/abstract/10.1103/PhysRevD.86.123014>.

Type of production: Scientific paper

Format: Journal

Position of signature: 1

Degree of contribution: Author or co-author of article in journal with external admissions assessment committee

Total no. authors: 3

Relevant results: The recent observation that the Cosmic Microwave Background (CMB) may prefer a neutrino excess has triggered a number of works studying this possibility. The effect obtained by the non-interacting massless neutrino excess could be mimicked by some extra radiation component in the early universe, such as a cosmological gravitational wave background. Prompted by the fact that a possible candidate to source those gravitational waves would be cosmic strings, we perform a parameter fitting study with models which considers both cosmic strings and the effective number of neutrinos as free parameters, using CMB and non-CMB data. We find that there is a correlation between cosmic strings and the number of extra relativistic species, and that strings can account for all the extra radiation necessary. In fact, CMB data prefer strings at a 2-sigma level, paying the price of a higher extra radiation component. CMB data also give a moderate preference for a model with $n_s=1$. The inclusion of non-CMB data lowers both the preference for strings and for the extra relativistic

Works submitted to national or international conferences

- 1** **Title of the work:** Non-linear dynamics of Axion Inflation

Name of the conference: The Universe in a Box

Corresponding author: Yes

City of event: Valencia, Spain

Date of event: 09/09/2022

End date: 09/09/2022

Organising entity: Instituto de Física Corpuscular **Type of entity:** State agency

City organizing entity: Valencia, Spain

Joanes Lizarraga.

- 2** **Title of the work:** Non-linear dynamics of Axion Inflation

Name of the conference: CosmoLattice School

Corresponding author: Yes

City of event: Valencia, Spain

Date of event: 05/09/2022

End date: 08/09/2022

Organising entity: Universitat de València **Type of entity:** University

City organizing entity: Valencia, Spain

Joanes Lizarraga.

- 3** **Title of the work:** Loop decay in Abelian-Higgs string networks

Name of the conference: Sixteenth Marcel Grossmann Meeting

Corresponding author: Yes

City of event: Rome, Italy

Date of event: 05/07/2021

End date: 10/07/2021

Organising entity: International Center for Relativistic Astrophysics Network (ICRA)

City organizing entity: Rome, Italy

Joanes Lizarraga.

- 4** **Title of the work:** Irreducible gravitational wave emission from a network of cosmic defects
Name of the conference: International Conference on Particle Physics and Cosmology (COSMO19)
Corresponding author: Yes
City of event: Aachen, Germany
Date of event: 02/09/2019
Organising entity: RWTH Aachen University
City organizing entity: Aachen, Germany
Joanes Lizarraga.

- 5** **Title of the work:** Irreducible gravitational wave emission from a network of cosmic defects
Name of the conference: Iberian Cosmology Meetings 2019
Corresponding author: Yes
City of event: Bilbao, Basque Country, Spain
Date of event: 17/04/2019
Organising entity: Universidad del País Vasco **Type of entity:** University
City organizing entity: Bilbao, Basque Country, Spain
Joanes Lizarraga.

- 6** **Title of the work:** Cosmic Microwave Background constraints for global strings and global monopoles
Name of the conference: International Conference on Particle Physics and Cosmology (COSMO17)
Corresponding author: Yes
City of event: Paris, Île de France, France
Date of event: 28/08/2017
Organising entity: Universidad Paris Diderot **Type of entity:** University
City organizing entity: Paris, Île de France, France
Joanes Lizarraga.

- 7** **Title of the work:** Improving CMB power spectra from Abelian-Higgs Cosmic Strings
Name of the conference: Cosmic Strings @ Brazil
Type of event: Workshop **Geographical area:** Non EU International
Type of participation: Participatory - oral communication **Reasons for participation:** Upon invitation
Corresponding author: Yes
City of event: Sao Carlos, Brazil
Date of event: 15/02/2016
End date: 19/02/2016
Organising entity: Universidade de Sao Paulo **Type of entity:** University
City organizing entity: Sao Carlos, Brazil
Joanes Lizarraga Olano.

- 8** **Title of the work:** Defektu kosmikoen zenbakizko simulazioak/Numerical simulations of cosmic defects
Name of the conference: IkerGazte 2015: first conference for basque researches
Type of event: Conference **Geographical area:** Regional
Type of participation: Participatory - oral communication **Reasons for participation:** Review before acceptance
Corresponding author: Yes



City of event: Durango, Basque Country, Spain

Date of event: 13/05/2015

End date: 15/05/2015

Organising entity: Udako Euskal Unibertsitatea **Type of entity:** Foundation

City organizing entity: Eibar, Basque Country, Spain

Joanes Lizarraga Olano; Asier Lopez Eiguren; Jon Urrestilla Urizabal. En: Defektu kosmikoen zenbakizko simulazioak. pp. 382 - 388. ISBN 978-84-8438-539-4

9 Title of the work: Can topological defects mimic the BICEP2 B-mode signal?

Name of the conference: Spanish Relativity Meetings (ERE) 2014

Type of event: Conference

Geographical area: National

Type of participation: Participatory - oral communication

Reasons for participation: Review before acceptance

Corresponding author: Yes

City of event: Valencia, Valencian Community, Spain

Date of event: 01/09/2014

End date: 05/09/2014

Organising entity: Universitat de València

Type of entity: University

City organizing entity: Valencia, Valencian Community, Spain

Publication in conference proceedings: Yes

With external admission assessment committee: No

Joanes Lizarraga Olano; Jon Urrestilla Urizabal; David Daverio; Mark Hindmarsh; Martin Kunz; Andrew R. Liddle. "Fitting BICEP2 with defects, primordial gravitational waves and dust". En: Fitting BICEP2 with defects, primordial gravitational waves and dust. 600, (United Kingdom): IOP Publishing LTD, ISSN 1742-6596

DOI: 10.1088/1742-6596/600/1/012025

10 Title of the work: Can topological defects mimic the BICEP2 B-mode signal?

Name of the conference: IX Iberian Cosmology Meeting

Type of event: Conference

Geographical area: European Union

Type of participation: Participatory - oral communication

Reasons for participation: Open access

Corresponding author: Yes

City of event: Aveiro, Centro (P), Portugal

Date of event: 28/04/2014

End date: 30/04/2014

Organising entity: Universidade de Aveiro. Gravitation Group

Type of entity: University Department

City organizing entity: Aveiro, Centro (P), Portugal

Joanes Lizarraga Olano.

11 Title of the work: Correlations between cosmic strings and extra relativistic species

Name of the conference: International Meeting of Fundamental Physics (IMFP) 2013

Type of event: Workshop

Geographical area: National

Type of participation: Participatory - oral communication

Reasons for participation: Review before acceptance

Corresponding author: Yes

City of event: Santander, Cantabria, Spain

Date of event: 20/05/2013

End date: 24/05/2013

Organising entity: Instituto de Física de Cantabria

Type of entity: University Research Institute

City organizing entity: Santander, Cantabria, Spain



Joanes Lizarraga Olano.

12 Title of the work: Correlations between cosmic strings and extra relativistic degrees of freedom

Name of the conference: VIIIITH Iberian Cosmology Meeting

Type of event: Conference

Geographical area: European Union

Type of participation: Participatory - oral communication

Reasons for participation: Open access

Corresponding author: Yes

City of event: Granada, Andalusia, Spain

Date of event: 24/04/2013

End date: 26/04/2013

Organising entity: Universidad de Granada

Type of entity: University

City organizing entity: Granada, Andalusia, Spain

Joanes Lizarraga Olano.