Personal Information

Name: Alba Domi
Date of Birth: 25/05/1991
Civil state: Married
Fiscal code: DMOLBA91E65Z100N
Languages: Italian (native), English (fluent), Albanian (fluent), French (basic), Mandarin (basic)
Email: albadomi@hotmail.it

Research Interest

My research interest lies in the field of astroparticle physics with high energy neutrino telescopes, cosmology with optical astronomy and space experiments. My career started within the KM3NeT Collaboration, for which, during my master thesis in Physics, I have evaluated for the first time the KM3NeT/ORCA sensitivity to WIMP-like dark matter annihilation in the Sun. During my PhD I have worked in both the ANTARES and KM3NeT telescopes in the search for light sterile neutrinos: **my work has put stringent limits on the sterile-active mixing parameters** using ANTARES data and it has shown the great sensitivity that KM3NeT/ORCA has for this research. Specifically, in the case of KM3NeT/ORCA, I have evaluated, for the first time ever in the field of neutrino telescopes, the sensitivity to the active-sterile mixing parameters also in the very low sterile neutrino mass region, which is not yet excluded by cosmological observations. My results have demonstrated how much neutrino telescopes can help in probing the sterile neutrino hypothesis. At the same time, **I have developed a new, official, shower reconstruction algorithm for KM3NeT/ORCA**: shower-like events are the most important for the neutrino mass ordering determination, the main goal of ORCA, and my shower reconstruction algorithm has proved to overcome the previous shower reconstruction algorithms performances. Therefore, **it is now the official shower reconstruction algorithm in KM3NeT/ORCA and it is currently used for all ORCA analyses**. I have also developed an online tool for a real-time analysis of the KM3NeT data with the aim of monitoring the status of the detector and the quality of the data. These works have allowed me to deeply understand the operation of high energy neutrino telescopes and highly advance in terms of analysis tool development. Thanks to the experience I have gained, the KM3NeT Collaboration has appointed me as **convener of the "Data Processing and Data Quality" working group**, whose goal is to analyse the quality of the first data coming from KM3NeT (ARCA & ORCA). As a Post-doc, I started developing an event classifier in KM3NeT/ARCA for very high energy neutrinos, based on a deep learning approach (graph neural networks specifically). My work will allow to optimise neutrino searches from astrophysical sources in KM3NeT/ARCA and it will be used both in the follow up and for online classification. For the latter, the goal of my classifier will be to trigger the alerts for the other telescopes, for multi-messenger searches. In the context of neutrino physics, I have won the call HORIZON-MSCA-2021-PF-01-MSCA Postdoctoral Fellowships 2021 with the QGRANT project which aims at performing a global search of quantum gravity effects with all the available data of the IceCube+KM3NeT+ANTARES neutrino telescopes. For this reason, I am now also a member of the IceCube collaboration.
In parallel to my work within KM3NeT and ANTARES, I have been focused on applying data-analysis methods used in astroparticle physics into optical astronomy, and specifically on the Hubble constant measurement via optical monitoring of gravitational lensed quasars. In this respect, I have proposed an idea to measure the time delay in unresolved lensed systems, to allow the time delay extraction from the monitoring of small/medium-sized optical telescopes. This has the advantage of increasing the statistics in the time delay estimation and therefore reducing the error on the Hubble parameter. A work on this has been published to Monthly Notices of the Royal Astronomical Society.
Lastly, I am involved in space experiments via a "Call for Ideas" from European Space Agency (ESA) in which I have proposed a novel instrument for geophysics and cosmic ray measurements, and which will allow to enhance the sensitivity of future, lunar-based, radio telescopes.

Current Position and Career

Marie Skłodowska-Curie Fellow **01/10/2022 – present**
Erlangen Centre for Astroparticle Physics,
Friedrich-Alexander University, Erlangen-Nürnberg (Germany).

Post-doctoral researcher **01/06/2021 – 31/08/2022**
University of Amsterdam & NIKHEF (Netherlands).

Post-doctoral researcher **01/06/2020 – 31/05/2021**
University of Genoa & INFN-Genoa (Italy).

Post-doctoral researcher **01/12/2019 – 31/05/2020**
Erlangen Centre for Astroparticle Physics,
Friedrich-Alexander University, Erlangen-Nürnberg (Germany).

Member of international scientific collaborations/networks

Member of the IceCube collaboration **15/12/2022 – present**

Member of the "European Cooperation in Science & Technology" (COST) action CA18108 on Quantum Gravity phenomenology in the multi-messenger approach **28/01/2022 – present**
Link: https://www.cost.eu/actions/CA18108/

Member of the European Space Agency (ESA) Geophysics topical team **2021 – present**

Member of the KM3NeT collaboration **2016 – present**

Member of the ANTARES collaboration **2016 – present**

Roles within the KM3NeT Collaboration

Convener of the "Data Processing & Data Quality" working group **15/03/2021 – 15/09/2023**

Member of the Scientific Steering Committee (SSC) **15/03/2021 – 15/09/2023**

Run Coordinator **01/05/2020 – 01/07/2020**

Roles outside the KM3NeT Collaboration

Guest editor of Symmetry special issue on "Advances in neutrino physics experiments" **2023**
Link: https://www.mdpi.com/journal/universe/special_issues/F0342861KC

Reviewer for the scientific journal "The Astrophysical Journal" **2022 – present**

Member of the Reviewer Board of the scientific journal "Symmetry" **13/11/2020 – present**
Link: https://www.mdpi.com/journal/symmetry/submission_reviewers

Lead author of "MOONLIght" for the European Space Agency "Call for Ideas" for exploring the Moon with a large European lander **03/07/2020 – present**

Link:
https://ideas.esa.int/servlet/hype/IMT?documentTableId=45087625533105171&userAction=Browse&templateName=&documentId=cf3e61d34d56bed69f0f2366b03a0f11

Responsible for Observational Cosmology
at ORSA (Observations and Research in Astronomical Sciences) **2018 – present**
Link: http://www.orsa.unige.net/index.php/en/people/

Grants, Fellowships and Awards

Italian qualification for Associate Professor in astrophysics **05/06/2023**
ID: ASN-02/C1.

Italian qualification for Associate Professor in experimental particle physics **24/05/2023**
ID: ASN-02/A1.

Marie Skłodowska-Curie Fellowship **01/10/2022 – present**
Program: HORIZON-MSCA-2021-PF-01-01.
Project Name: QGRANT (Quantum GRavity seArches with Neutrino Telescopes)
Project ID: 101068013.
Budget: 189,687 k€.

Seal of Excellence for the Marie Skłodowska-Curie actions **26/03/2021**
Program: H2020-MSCA-IF-2020.

Education

Co-Ph.D., Physics **01/11/2016 - 16/12/2019**
University of Genoa (Italy) and University of Aix-Marseille (France)
Title: "*Shower Reconstruction and Sterile Neutrino Analysis with KM3NeT/ORCA and ANTARES*"
Supervisors: Dr. Marco Anghinolfi, Prof. Dr. Mauro Taiuti, Dr. Paschal Coyle

Master degree, Physics **01/11/2014 - 27/10/2016**
University of Genoa (Italy)
Title: *"Indirect Search of Dark Matter Annihilation in the Sun with KM3NeT/ORCA"*
Supervisors: Dr. Marco Anghinolfi, Prof. Dr. Mauro Taiuti
Grade: 110 /110 cum Laude

Bachelor Degree, Physics **20/09/2010 – 26/03/2014**
University of Genoa (Italy)

Publications

Within the ANTARES and KM3NeT Collaborations: As member of the ANTARES and KM3NeT Collaborations I sign all the papers published by both the experiments. To date (19/11/2023) **I have co-authored a total of 71 papers, with 2489 citations (excluding self-citations) and an h-index of 15**. The full list publications co-authored by me is available on iNSPIRE
(https://inspirehep.net/literature?sort=mostrecent&size=25&page=1&q=find%20a%20domi&ui-citation-summary=true&ui-exclude-self-citations=true).
Here, I will list the ones to which I have directly contributed, in chronological order:

- The KM3NeT Collaboration (main author: **A. Domi**), *Lorentz Invariance Violation with KM3NeT/ORCA115, PoS* ICRC2023 (2023) 1086. DOI: 10.22323/1.444.1086.
- The KM3NeT Collaboration (main author: F. Filippini, E. Androutsou, **A. Domi**, B. Spisso, E. Drakopoulou), *Data reconstruction and classification with Graph neural networks in KM3NeT/ARCA*, PoS ICRC2023 (2023) 1194. DOI: 10.22323/1.444.1194.
- The KM3NeT Collaboration (main authors: S: Reck, D. Guderian, G. Vermarien, **A. Domi**), *Graph Neural Networks for reconstruction and classification in KM3NeT,* JINST 16 (2021) C10011. DOI: 10.1088/1748-0221/16/10/c10011.
- The KM3NeT Collaboration (main authors: **A. Domi**, J. A. B. Coelho, T. Thakore), *Sensitivity to light sterile neutrino mixing parameters with KM3NeT/ORCA.* JHEP 10 (2021) 180. DOI: https://doi.org/10.1007/JHEP10(2021)180.
- The ANTARES and KM3NeT Collaborations (main authors: **A. Domi**, J. A. B. Coelho), *Search for Sterile Neutrinos with KM3NeT/ORCA and ANTARES*. PoS(ICRC2019)870.
- The ANTARES Collaboration (main authors: I. Salvadori, J. Brunner, A. **Domi** → for the 3+1 neutrino model analysis), *Measuring the atmospheric neutrino oscillation parameters and constraining the 3+1 neutrino model with ten years of ANTARES data*. JHEP 06 (2019) 113. DOI: https://doi.org/10.1007/JHEP06(2019)113.
- The KM3NeT Collaboration (main authors: A. **Domi**, S. Bourret, L. Quinn), *Particle Physics with ORCA*. EPJ Web Conf. 207 (2019) 04003. DOI: https://doi.org/10.1051/epjconf/201920704003.

Other Publications outside the ANTARES and KM3NeT Collaborations:

- L. Biggio, **A. Domi**, S. Tosi, G. Vernardos, D. Ricci, L. Paganin, G. Bracco, *Time delay estimation in unresolved lensed quasars*, MNRAS (2022) stac2034. DOI: https://doi.org/10.1093/mnras/stac2034.
- A. Aurisano, A. Dighe, **A. Domi**, et al, *Sterile neutrino searches with atmospheric neutrinos, Snowmass 2021 – Letter of Interest.* Link: https://www.snowmass21.org/docs/files/summaries/NF/SNOWMASS21-NF2_NF4_Sousa_Thakore-134.pdf .
- L. Cutroneo, M. Capello, A. **Domi**, et al, *Microplastics in the abyss: a first investigation into sediments at 2443 m depth (Toulon, France), Environmental Science and Pollution Research* 29 (2022) 9375-9385. DOI: https://link.springer.com/article/10.1007/s11356-021-17997-z.
- D. Ricci, S. Tosi, L. Cabona, C. Righi, A. La Camera, A. Marini, A. **Domi**, et al, *Commissioning of the instrumentation and launch of the scientific exploitation of OARPAF, the Regional Astronomical Observatory of the Antola Park,* JATIS 7 (2021) 025003. DOI: https://doi.org/10.1117/1.JATIS.7.2.025003.
- A. V. Akinidov et al, *Letter of Interest for a Neutrino Beam from Protvino to KM3NeT/ORCA***,** Eur. Phys. J. C (2019) 79: 758. DOI: https://doi.org/10.1140/epjc/s10052-019-7259-5.
- N. Alchera, M. Bonici, R. Cardinale, A. **Domi**, N. Maggiore, C. Righi, S. Tosi, *Analysis of the angular dependence of time delay in gravitational lensing*, Symmetry 10 (2018) 246. DOI: https://doi.org/10.3390/sym10070246.

Internal Notes

Within the ANTARES and KM3NeT Collaborations:

- M. Anghinolfi, C. D'Amato, **A. Domi**, C. Hugon, G. Riccobene, *The system to mitigate sediment deposition in the upper surface of the Digital Optical Module in KM3NeT: Part II.* Link: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwiYvKiwgKjrAhVS4aQKHdSOBDoQFjAAegQIAhAB&url=https%3A%2F%2Fwww.lnf.infn.it%2Fsis%2Fpreprint%2Fpdf%2Fgetfile.php%3Ffilename%3DINFN-16-14-GE.pdf&usg=AOvVaw0ffCSM2c7AIOGLEU4qPf-4
- C. Hugon, **A. Domi**, M. Sanguineti, M. Anghinolfi, *The system to mitigate sediment deposition in the upper surface of the Digital Optical Module in KM3NeT.* Link: http://www.lnf.infn.it/sis/preprint/detail-new.php?id=5381

Conferences

- **Poster** at ICRC2023 with title: "*Lorentz Invariance Violation with KM3NeT/ORCA115*". Link: https://pos.sissa.it/444/1086/
- **Poster** at ICRC2023 with title: *"Data reconstruction and classification with GNNs in KM3NeT/ARCA6-8"*. Link: https://pos.sissa.it/444/1194/
- **Talk** at COST CA18108 conference 2023 (Rijeka) with title: "*Lorentz Invariance Violation with KM3NeT/ORCA115*". Link: https://indico.capa.unizar.es/event/31/contributions/428/
- **Poster** at Neutrino 2022 conference with title: "*Sterile Neutrino searches with KM3NeT/ORCA*". Link: https://indico.kps.or.kr/event/30/contributions/135/
- **Panelist** at the #36 discussion session on "Shower Reconstructions and Pointing" at ICRC2021. Link: https://icrc2021.desy.de
- Presentation of our work by a PhD student at VLVnT 2021 as a **talk** with the title: "*Graph Neural Networks for reconstruction and classification in KM3NeT"*.
  Link: https://indico.ific.uv.es/event/3965/contributions/14775/
- **Talk** at VLVnT 2021 with title: "*Search for light sterile neutrinos with ANTARES and KM3NeT/ORCA telescopes* ".
  Link: https://indico.ific.uv.es/event/3965/contributions/14769/
- **Poster** at Neutrino 2020 with title: "*Sensitivity study of KM3NeT-ORCA to Sterile Neutrinos"*. Link: https://zenodo.org/record/4254138#.YVxbQy0Ro1I
- **Poster** at ICRC2019 with title: "*Search for Sterile Neutrinos with KM3NeT/ORCA and ANTARES"*. Link: https://www.icrc2019.org/poster-session-1.html
- **Talk** at NeuTel 2019 with title: "*Fundamental physics with deep-sea neutrino telescopes"*. Link: https://indico.cern.ch/event/768000/contributions/3274992/
- **Talk** at VLVnT 2018 with title: "*Particle Physics with ORCA"*.
  Link: https://indico.jinr.ru/event/633/contributions/5372/
- **Talk** at VHEPU 2018. Title of the talk: "*KM3NET/ORCA: perspectives and multisearch potential of an underwater neutrino telescope*".
  Link: http://vietnam.in2p3.fr/2018/vhepu/Parallel_Sessions_1.html#PS3

Invitation to Seminars, Colloquia, Conferences and Schools

Invited talk at the Science Week Event in Tirana **21/11/2023**
Lecture title: *Fundamental physics and astrophysics with the KM3NeT neutrino telescope*
Link: https://indico.cern.ch/event/1347072/

Invited lecture at the Vietnam School on neutrinos **22/07/2023**
Lecture title: *Neutrino astronomy.*
Link: https://ifirse.icise.vn/nugroup/vson/2023/lecturer.html

Invited talk at Neutrino Workshop at IFIRSE **18/07/2023**
Talk title: *Lorentz and CPT violation search with on-going and future neutrino experiments*
Link: https://ifirse.icise.vn/nugroup/nuworkshop2023/program.html#july18

Invited seminar at TU Dortmund **19/04/2023**
Seminar title: Quantum gravity searches with neutrino telescopes.

Invited Seminar at ECAP **24/11/2022**
Seminar title: *Quantum gravity searches with neutrino telescope.*

Link: https://ecap.nat.fau.de/index.php/event/ecap-seminar-2022-11-24-alba-domi/

Invited Seminar at the DESY Astroparticle **17/06/2021**
Seminar title: *Neutrino oscillation studies and cosmic neutrino searches with KM3NeT.*
Link: https://indico.desy.de/event/34149/

Invited Colloquium at the
GRAPPA Center (GRavitational AstroParticle Physics Amsterdam) **1/11/2021**
Colloquium title: *Time delay estimation in unresolved lensed quasars*
Link: http://grappa.amsterdam/grappaseminars/

Supervising and Mentoring Activities

Co-supervisor of PhD Thesis in Physics **present**
Student name: Lukas Hennig.
Institution: ECAP-FAU (Germany).
Thesis title: *Combined search for quantum gravity effects with ANTARES+KM3NeT+IceCube.*

Co-supervisor of Master Thesis in Physics **present**
Student name: Leonardo Malerba.
Institution: University of Genova (Italy).
Thesis title: *Search for Lorentz Invariance Violation with KM3NeT/ORCA6.*

Co-supervisor of Master Thesis in Physics **present**
Student name: Bastian Setter.
Institution: ECAP-FAU (Germany).
Thesis title: *Event reconstruction with Graph Neural Networks in KM3NeT/ORCA6.*

Co-supervisor of Bachelor Thesis in Physics **2022**
Student name: Nina Van Der Meulen.
Institution: University of Amsterdam (the Netherlands).
Thesis title: *Neutrino event classification with Machine Learning: Track/shower classification with a Graph Neural Network in KM3NeT/ARCA6.*

Co-supervisor of Master Thesis in Physics. **2018 - 2019**
Student name: Francesco Nicolosi.
Institution: University of Genova (Italy).
Thesis title: *Study of quasars under gravitational lensing effect for the determination of cosmological parameters using 1-m class optical telescopes.*

Teaching

Teaching Assistant for the Winter Seminar on Particle Physics and Astrophysics **2023-2024**
Institution: Friedrich-Alexander-UniversitätErlangen-Nürnberg (Germany)

Teaching Assistant for the General Physics course at Naval Engineering Faculty **2018 - 2019**
Institution: University of Genoa (Italy)

Teaching Assistant for the General Physics course at Naval Engineering Faculty **2017 - 2018**
Institution: University of Genoa (Italy)

Teaching Assistant for the General Physics 2 course at Geology Faculty **2017 - 2018**

Institution: University of Genoa (Italy)

Teaching Assistant for the General Physics course at Naval Engineering Faculty **2016 - 2017**
Institution: University of Genoa (Italy)

Organisation of International Conferences/Schools

Member of the local organising committee of the PUMA2022 Conference **26-30 Sept 2022**
Link: https://agenda.infn.it/event/18651/

Member of the local organising committee of the PhD School **5-8 Sept 2022**
"Optical astronomy in the multi-messenger era"
Link: http://www.orsa.unige.net/index.php/en/phd-school-2022/

Outreach

Member of the scientific committee of the Asimov Prize 2022 **present**
Link**:** https://www.premio-asimov.it/edizioni/edizione-2022/

Speaker for the Italian event "Giornata Nazionale dello Spazio" **16/12/2021**
Link:
https://life.unige.it/giornata-nazionale-dello-spazio-2021 - Event
https://www.youtube.com/watch?v=ZboYpx_r1GQ – Youtube direct

Member of the "KM3NeT Master Class" organization team **November 2021 - present**
Link:
https://www.km3net.org/wp-content/uploads/2018/10/D3.1-KM3NeT-Outreach-plan.pdf

Guest for the Scientific Quiz at the "European Night of Researchers" **22/09/2021**
Links:
https://www.sharper-night.it/evento/scientifiquiz/ - Event
https://www.youtube.com/watch?app=desktop&v=tQmliozm-_0 - YouTube direct

Member of the scientific committee of the Asimov Prize 2021 **February - May 2021**
Link**:** https://www.premio-asimov.it

Talk at the stage organised by Dipartimento di Fisica dell'Università degli Studi di Genova
for high school students. **30/04/2021**
Title of the talk: *Osservare le profondità del cosmo dalle profondità del mare con il telescopio KM3NeT*

Author of an Educational Article on The Hubble constant measurements
for the Italian Podcast "Scientificast" **10/06/2020**
Link: https://www.scientificast.it/costante-hubble-crisi-smisurata/

Member of the local organising committee of the Pint of Science Event **January 2020 - present**
City: Genoa (Italy)
Link: https://pintofscience.it/team/Team%20Genova

Member of the local organising committee and Moderator
at the "Man on the Moon" Public Event **16/07/2019 - 20/07/2019**
City: Genoa (Italy)
Links:
1) http://www.orsa.unige.net/index.php/it/50-anni-allunaggio/
2) https://unige-backend.s3-eu-west-1.amazonaws.com/5d2737bee373e504002c6389/Man%20on%20the%20Moon%20-%20programma.pdf

Public presentation for the Pint of Science Event **15/05/2018**
City: Genoa (Italy)
Title: *"The Universe Expansion Measured in our Mountains"*
Link: https://pintofscience.it/event/lespansione-delluniverso-misurata-sui-nostri-monti