Francesca Capel

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Education

2015 - present **Doctor of Philosophy (PhD)**
KTH Royal Institute of Technology, Sweden
- Supervised by C. Fuglesang, M. Pearce and D. J. Mortlock.
- Thesis title: *Identifying the origin of ultra-high-energy cosmic rays: novel instrumentation and analysis aspects.*
- Planned graduation in June 2020

2012 - 2013 **Master thesis (Erasmus Program)**
École Polytechnique Fédérale de Lausanne (EPFL), Switzerland
- Supervised by I. Furno and B. Labit
- Thesis title: *Characterization of scrape-off layer plasma using Langmuir probes in the TCV tokamak.*

2010 - 2014 **Msci. (Hons.) Degree in Physics with First Class Honours**
Imperial College London, United Kingdom

Research positions

2014 - 2015 **Young Graduate Trainee**
ESTEC, European Space Agency (ESA), The Netherlands
- Testing and calibration of a novel highly miniaturised radiation monitor for space applications.

Jul - Aug 2009 **Nuffield Science Bursary holder**
Department of Electrical Engineering, Cardiff University, United Kingdom

Selected talks

Jul 2019 **American Statistical Association - Joint Statistical Meetings, Denver**
Invited Impact of using the UHECR arrival energies to constrain source associations.

Jul 2019 **European Physical Society - High Energy Physics, Ghent**
Invited Multi-messenger astroparticle physics through hierarchical modelling.

Nov 2018 **Bayes Forum, Max Planck Institute for Astrophysics, Munich**
Invited A hierarchical model for the energies and arrival directions of UHECRs.

Aug 2018 **TeV Particle Astrophysics, Berlin**
Connecting UHECR theory to data with Bayesian hierarchical models.

Feb 2018 **Research Seminar, University of Turin**
Invited Scientific goals of the Mini-EUSO mission.

Jun 2017 **Science Coffee, ESTEC, European Space Agency, Noordwijk**
Invited The Mini-EUSO instrument.

Grants & Awards

Nov 2019	**1,445.6 kSEK** from the Swedish National Space Agency for postdoctoral work on the analysis of Mini-EUSO data (Co-applicant with C. Fuglesang and P. Carlson).
Jun 2019	**9.8 kSEK** from Jubileumsanslaget for travel to the JSM conference.
May 2019	**15. kSEK** from Galöstiftelsen for travel to the EPS-HEP conference.
Jan 2019	Shortlisted as one of four finalists for the American Statistical Association's *Best Astrostatistics Student Paper Award*.
Jun 2018	**18.9 kSEK** from Signeuls Stiftelsen for travel to the TeVPA conference.
Aug 2018	**500 EUR** TeVPA award for *Excellent Young Scientists*.
Nov 2017	**50 kSEK** from Alexandra och Bertil Gyllings Stiftelesen for research visits and equipment related to the Mini-EUSO project.

Teaching & supervision

Teaching assistant for the *Radiation, Protection, Dosimetry and Detectors* and *Modern Physics* courses at KTH Royal Institute of Technology during the autumn semester of 2015 and 2016.

Erasmus student theses from the University of Turin

- D. D'Ago, *Simulations of UHECR induced air showers in ESAF*, Aug 2017.
- S. Durando, *Data analysis for the EUSO-SPB mission*, Aug 2017.
- A. Liberatore, *Optimization of the L2 trigger algorithm for Mini-EUSO*, Aug 2016.

Bachelor student theses at KTH Royal Institute of Technology

- C. Eriksson & V. Minoz, *Development of a Helmholtz coil for the MIST satellite*, May 2019.
- M. Al-Janabi & L. Fischer, *A subsystem simulator for the MIST satellite*, May 2019.
- F. Hülphers, *Identification of UHE cosmic rays using neural networks*, May 2018.
- P. Bühlmann & J. Sigvant, *Simulation study of meteors for Mini-EUSO*, May 2017.

Outreach

Nov 2018/19	*Gravitational waves*, popular science seminar for undergraduate students at KTH.
Sept 2018	*Exploring the universe with ultra-high-energy cosmic rays*, KTH Library public seminar series: `https://www.youtube.com/watch?v=HK0hus6qBXQ`.
Feb 2018	Interview with *Rymdstyrelsen (Swedish National Space Agency)* space blog (in Swedish): `https://www.youtube.com/watch?v=-vEmMWaM5cU`.
Oct 2017	*Gravitational waves*, invited popular science talk at the KTH PhD Conference.
Oct 2014	Volunteer at the European Space Agency's open day at ESTEC.

Skills & scientific services

Programming & software development (GitHub: `https://github.com/cescalara`)

- Advanced: C/C++, python, Stan
- Competent: VHDL and high-level synthesis, Xilinx Vivado Design Suite, ROOT, Geant4.
- Familiar: R, MATLAB, Fortran, Tensorflow, AutoCAD, Accuro TCAD.

Languages

- Mother tongue: English.
- Fluent: Swedish, French.

Scientific services

- Referee for the *Monthly Notices of the Royal Astronomical Society* journal.
- Organizer of the 18$^{\text{th}}$ JEM-EUSO Collaboration Meeting, Stockholm 7$^{\text{th}}$-11$^{\text{th}}$ December 2015.

Publications

Scopus Author ID: 57190564754
ORCiD: https://orcid.org/0000-0002-1153-2139
Google Scholar: https://scholar.google.com/citations?user=jKM43oUAAAAJ

Refereed

I have a total of **9** publications in refereed academic journals, including papers with the full JEM-EUSO Collaboration author list. In this section, I first list publications that I have lead and then collaboration papers on which I am a co-author. For the latter, I also highlight my specific contributions, where relevant.

Publications as lead author

1. **Capel, F.** et al., Mini Extreme Universe Space Observatory data acquisition and control software. *Journal of Astronomical Telescopes and Instrumentation*, (In press), arXiv:1907.04938.

2. **Capel, F.** & Mortlock, D. J., 2019, Impact of using the ultra-high-energy cosmic ray arrival energies to constrain source associations. *Monthly Notices of the Royal Astronomical Society*, 484, 2324, 10.1093/mnras/stz081.

3. **Capel, F.** et al., 2018, Mini-EUSO: A high resolution detector for the study of terrestrial and cosmic UV emission from the International Space Station. *Advances in Space Research*, 62, 2954, 10.1016/j.asr.2017.08.030.

4. Belov, A., Bertaina, M. **Capel, F.*** et al., 2018, The integration and testing of the Mini-EUSO multi-level trigger system. *Advances in Space research*, 62, 2966, 10.1016/j.asr.2017.10.044.

   *** Capel, F.** is corresponding author, but author list is alphabetically ordered.

Collaboration papers

5. Abdellaoui, G. et al. (The JEM-EUSO Collaboration), 2019. Ultra-violet imaging of the night-time earth by EUSO-Balloon towards space-based ultra-high energy cosmic ray observations. *Astroparticle Physics*, 111, 54, 10.1016/j.astropartphys.2018.10.008.
   I served on the internal review panel within the collaboration to improve the quality of the paper prior to submission.

6. Abdellaoui, G. et al. (The JEM-EUSO Collaboration), 2018. EUSO-TA – First results from a ground-based EUSO telescope. *Astroparticle Physics*, 102, 98, 10.1016/j.astropartphys.2018.05.007.
   I contributed to the UHECR observation campaign with EUSO-TA at the Telescope Array Project site in Utah in November 2015. This involved operating the detector, as well as data processing and reduction.

7. Abdellaoui, G. et al. (The JEM-EUSO Collaboration), 2018. First observations of speed of light tracks by a fluorescence detector looking down on the atmosphere. *Journal of Instrumentation*, 13(05), 05023, 10.1088/1748-0221/13/05/P05023.

8. Abdellaoui, G. et al. (The JEM-EUSO Collaboration), 2017. Cosmic ray oriented performance studies for the JEM-EUSO first level trigger. *Nuclear Instruments and Methods in Physics Research Section A*, 866, 150, 10.1016/j.nima.2017.05.043.

9. Abdellaoui, G. et al. (The JEM-EUSO Collaboration), 2017. Meteor studies in the framework of the JEM-EUSO program. *Planetary and Space Science*, 143, 245, 10.1016/j.pss.2016.12.001.

Conference proceedings

Here, I list selected conference proceedings to highlight my contributions as part of the JEM-EUSO Collaboration. The policy is to include contributors in alphabetical order following the presenter.

10. Bisconti, F. et al., Mini-EUSO engineering model: tests in open-sky condition. *Proceedings of the 36th International Cosmic Ray Conference (ICRC 2019)*, PoS, 198.

11. Miyamoto, H. et al. The EUSO@ TurLab: Test of Mini-EUSO Engineering Model. *Proceedings of the 36th International Cosmic Ray Conference (ICRC 2019)*, PoS, 194.

12. **Capel, F.** et al., 2017, Mini-EUSO flight software and operations on ISS. *Proceedings of the 35th International Cosmic Ray Conference (ICRC 2017)*, PoS, 454.

13. **Capel, F.** et al., 2017, The Mini-EUSO multi-level trigger algorithm and its performance. *Proceedings of the 35th International Cosmic Ray Conference (ICRC 2017)*, PoS, 453.

14. Fenu, F. et al., 2016. Preliminary analysis of EUSO–TA data. *Journal of Physics: Conference Series*, 718(5), p.052011.

Software

As part of my PhD work, many of my contributions have been in the form of software. I am an advocate for open-source development and re-useable code. In this way, I make all the products of my work available under flexible licenses for further use. Here, I list some of my publicly available code repositories.

15. **Capel, F.**, 2019, The Mini-EUSO data acquisition and control software v.8.1.1, *Zenodo*, 10.5281/zenodo.3301872.

16. **Capel, F.**, 2019, Impact of using the UHECR arrival energies to constrain source associations v.1.0.0, *Zenodo*, 10.5281/zenodo.2559286.

17. **Capel, F.**, 2019, Hardware testbench project for the Mini-EUSO L2 trigger (HLS implementation), *Zenodo*, 10.5281/zenodo.3301720.

18. **Capel, F.**, 2019, Custom IP for the Mini-EUSO PDM-DP Zynq system v.1.3.1, *Zenodo*, 10.5281/zenodo.2559306.