# Dr Maria Vincenzi

**Research scholar**
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**I work on Supernova Ia cosmology and I am currently the lead of the cosmological analysis of the Dark Energy Survey (DES) Supernova sample, which is the largest and deepest SN sample from single telescope currently available. This analysis involves approximately a team of twenty members of the DES Collaboration and it will result in the most precise measurement of the acceleration of the expansion of our Universe from SNe Ia.**

## Education

2017 – 2021 **Ph.D. Physics**, Institute of Cosmology and Gravitation, Portsmouth, UK.
Supervisors: Prof. Bob Nichol (University of Portsmouth), Prof. Mark Sullivan (University of Southampton)
*My Ph.D. program was founded by the Data Intensive Science Centre in the South-East Physics Network (DISCnet, https://www.discnet.sussex.ac.uk). This was a four-year based program, it included training on Machine Learning and Data Science and internships with various industrial partners.*

2014 – 2017 **MSc in Astrophysics**, University of Milan, Milan, Italy.
Grade: *Magna cum laude*

2010 – 2014 **BSc in Physics**, University of Milan, Milan, Italy.
Grade: *106/110*

## Research & Professional Experience

2021 Nov – *present* **Postdoctoral position**, Duke University, Durham, NC, USA.
Leading the cosmological analysis of the DES Supernova sample.

2021 Aug – Oct **Postdoctoral position**, University of Southampton, Southampton, UK.

2019 Jun – Aug: **Summer internship at Quant Foundry Limited**, London, UK
I developed Machine Learning models for the estimation of probability of default of low-risk portfolios.

2017 Jan – Jun: **Independent Contractor**, Lawrence Berkeley National Laboratory (LBNL), Berkeley (CA), USA
I worked on the development of the data processing pipeline for the Nearby Supernova Factory.

2016 Mar – Dec: **MSc thesis project**, LBNL, Berkeley (CA), USA
I worked under the supervision of Nobel Laureate Prof. Saul Perlmutter on the data processing pipeline for the Nearby Supernova Factory.

2015 Jun – Aug: **Leiden/ESA program for summer students**, Leiden, Netherlands
10-weeks program working on stellar and planetary systems formation with Dr Carlo Manara and Dr Christian Schneider. My work resulted in a poster presented at the conference "The accretion/outflow connection in young stellar objects" (Leiden, October 2015).

2014 Jan – Feb: **BSc thesis project**, National Institute for Astrophysics (INAF), Milano, Italy
I worked on galaxy clusters with Dr Silvano Molendi (INAF)

## Prizes and scholarships

2022: **Universities Research Association (URA) and Fermilab outstanding doctoral thesis award**

2022: **Michael Penston Prize** for the best doctoral thesis in astronomy or astrophysics granted by the Royal Astronomical Society.

2016: Scholarship to support my MSc Thesis at LBNL, granted by the Rotary Club of Modena and the University of Milan.

## Collaborations

- 2020 – *present*: The 4MOST Time Domain Extragalactic Survey (TiDES) Collaboration
- 2019 – *present*: LSST Dark Energy Science Collaboration
- 2019 – *present*: Dark Energy Survey Collaboration (**Builder status**)
- 2018 – 2021: Junior Associate in the LSST:UK Consortium
- 2016 – 2018: Nearby Supernova Factory

## Talks and Seminars

### *Invited talks*

2022 Jul: *SN Ia cosmology with photometric SN samples*, invited speaker at the BOOM! Conference at University of Illinois (Urbana-Champaign, USA)

2022 Jun: *SN Ia cosmology with the Dark Energy Survey*, speaker at the Fermilab User Meeting in occasion of the ceremony for the URA and Fermilab doctoral thesis award (Chicago, USA)

2021 Dec: *SN Ia cosmology with the Dark Energy Survey*, speaker at the University of Chicago KICP seminar series (Chicago, USA)

2021 Feb: *Core Collapse contamination in DES SN Ia cosmology*, Invited talk at the LSST Dark Energy Science Collaboration transient working group (Virtual)

2020 Oct: *Core Collapse contamination in SN Ia cosmology*, Invited talk at the Transient Tuesday seminar series at DARK (Copenhagen, DK)

2019 May: *Simulation of core collapse contamination in the LSST era*, Invited talk at LSST:UK Meeting, University of Cardiff (Cardiff, UK)

2019 Apr: *ML in the LSST era*, Invited talk at SciML seminar series at Rutherford Appleton Laboratory (Oxford, UK)

### *Talks on behalf of the DES Supernova working group*

2021 Jul: *Cosmology with the DES-SN sample*, talk on behalf of the DES-SN working group, National Astronomy Meeting 2021 (Bath, UK).

2021 Jan: *Cosmology with the DES-SN sample*, talk on behalf of the DES-SN working group, 237th American Astronomical Society Meeting (Virtual).

2019 Nov: SN working group update at the Plenary Session, DES Collaboration Meeting at University of Sussex (Brighton, UK)

### *Other talks and seminars*

2019 Oct: *Core Collapse contamination in SN Ia cosmology*, Supernova Cosmology Analysis Meeting, KICP (Chicago, USA)

2018 Apr: *Spectro-photometric templates of core collapse supernovae*, European Week of Astronomy and Space Science (Liverpool, UK)

## Mentoring, Teaching Experiences, Outreach & Public Engagement

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| 2022: | Supervised Ava Bailey, an undergraduate student at Duke University, for a summer project on SN cosmology forecasts from LSST+Euclid. The project resulted in a publication (see list of Publications). |
| 2021: | Co-supervised Ryan Camilleri, undergraduate student at the University of Queensland, for his Master thesis project. |
| 2019: | Lecture on Machine Learning in Astronomy for Computer Science undergraduate students at the University of Portsmouth. |
| 2018: | TA for the Computational Physics unit at the University of Portsmouth. |
| 2017: | Private tutor in Physics to a class of ten undergraduate students in Mechanical Engineering at Camplus Residential College (Milan, Italy). |

## Outreach & Public Engagement

In 2019 and 2020, I was the Outreach and Public Engagement (OPE) student representative at the Institute of Cosmology and Gravitation. As a OPE student representative, I helped with the organisation of the Stargazing Event, an evening of activities and talks promoted every year by the ICG and attended by 1500 members of the public. I also organised several astronomy-related activities tailored for primary school kids and I presented these at various girl scout local groups to encourage engagement of girls in STEM.

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## Publications

### *Lead Author Publications*

1. A. Bailey, **M. Vincenzi**, et al., *Type Ia Supernova cosmology combining data from the Euclid mission and the Vera C. Rubin Observatory*, arXiv e-prints, (2022), p. arXiv:2211.01206.
   - Supervised Duke undergraduate student Ava Bailey, run simulations and various aspects of the analysis, significant contribution to paper writing;
2. R. Wiseman, **M. Vincenzi**, and DES Collaboration, *A galaxy-driven model of type Ia supernova luminosity variations*, MNRAS, 515 (2022), pp. 4587–4605.
   - Contributed to the development of the model, run part of the simulations and provided tools to measure bias-corrected Hubble residuals for data and sims;
3. **M. Vincenzi** et al., *The Dark Energy Survey Supernova Program: Cosmological biases from supernova photometric classification*, MNRAS, (2022).
   - Led all aspects of the analysis and wrote the paper;
4. C. Frohmaier, C. R. Angus, **M. Vincenzi**, et al., *From core collapse to superluminous: the rates of massive stellar explosions from the Palomar Transient Factory*, MNRAS, 500 (2021), pp. 5142–5158.
   - Run core-collapse simulations and test survey efficiency, contributed to paper writing;
5. **M. Vincenzi** et al., *The Dark Energy Survey Supernova Programme: modelling selection efficiency and observed core-collapse supernova contamination*, MNRAS, 505 (2021), pp. 2819–2839.
   - Led all aspects of the analysis and wrote the paper;
6. **M. Vincenzi** et al., *Spectrophotometric templates for core-collapse supernovae and their application in simulations of time-domain surveys*, MNRAS, 489 (2019), pp. 5802–5821.
   - Led all aspects of the analysis and wrote the paper;

### *Other Publications*

7. M. Lokken, A. Gagliano, and LSST Dark Energy Science Collaboration **incl. M. Vincenzi**, *The Simulated Catalogue of Optical Transients and Correlated Hosts (SCOTCH)*, arXiv e-prints, (2022), p. arXiv:2206.02815.
   - Provided input files and support to run simulations, helped with the review of the manuscript;
8. D. Brout and Pantheon+ Team **incl. M. Vincenzi**, *The Pantheon+ Analysis: Cosmological Constraints*, ApJ, 938 (2022), p. 110.
   - Contributed to the analysis related to systematic uncertainties associated with calibration and light-curve fitting, provided comments;
9. L. Kelsey and DES Collaboration, **incl. M. Vincenzi**, *Concerning Colour: The Effect of Environment on Type Ia Supernova Colour in the Dark Energy Survey*, arXiv e-prints, (2022), p. arXiv:2208.01357.
   - Contributed to data curation, SN classification and modelling of selection bias effects. Provided comments to the manuscript;
10. R. Chen and DES Collaboration, **incl. M. Vincenzi**, *Measuring Cosmological Parameters with Type Ia Supernovae in redMaGiC galaxies*, ApJ, 938 (2022), p. 62.
    - Provided input files and support to run simulations needed for the analysis, helped with the review of the manuscript;

11. A. Moller and DES Collaboration **incl. M. Vincenzi**, *The Dark Energy Survey 5-year photometrically identified Type Ia Supernovae*, MNRAS, 514 (2022), pp. 5159–5177.
    - Contributed to improve the code used to produce the DES sample and helped with the testing, helped with revision of the manuscript;
12. D. Brout and Pantheon+ Team, **incl. M. Vincenzi**, *The Pantheon+ Analysis: SuperCal-Fragilistic Cross Calibration, Retrained SALT2 Light Curve Model, and Calibration Systematic Uncertainty*, ApJ, 938 (2022), p. 111.
    - Contributed to part of the analysis and provided Fig 5 and Table 4;
13. M. Grayling and DES Collaboration **incl. M. Vincenzi**, *Understanding the extreme luminosity of DES14X2fna, submited to MNRAS*, (2021).
    - Provided simulations of DES14X2fna-like events, run photometric classifier on them and evaluated performances, helped with revision of the manuscript;
14. M. Smith and DES Collaboration, **incl. M. Vincenzi**, *First cosmology results using type Ia supernovae from the Dark Energy Survey: the effect of host galaxy properties on supernova luminosity*, MNRAS, 494 (2020), pp. 4426–4447.
    - Provided comments to the manuscript;
15. P. Wiseman and DES Collaboration, **incl. M. Vincenzi**, *Supernova host galaxies in the dark energy survey: I. Deep coadds, photometry, and stellar masses*, MNRAS, 495 (2020), pp. 4040–4060.
    - Provided comments to the manuscript;
16. G. Aldering and SNFactory Collaboration **incl. M. Vincenzi**, *The SNEMO and SUGAR Companion Data Sets*, Research Notes of the American Astronomical Society, 4 (2020), p. 63.
    - Contributed to the development of the data processing pipeline, and provided comments;
17. C. Saunders and SNFactory Collaboration **incl. M. Vincenzi**, *SNEMO: Improved Empirical Models for Type Ia Supernovae*, ApJ, 869 (2018), p. 167.
    - Contributed to the development of the data processing pipeline, and provided comments;

### *In preparation*

18. C. Frohmaier, **M. Vincenzi**, and LSST Dark Energy Science Collaboration, 4MOST Collaboration, *TiDES – The 4MOST Time Domain Extragalactic Survey*, (expected 2022).
    - In Collaboration Internal Review. Run LSST simulations and run cosmology pipeline to predict dark energy cosmological constraints from LSST+TiDES, significant contribution to paper writing;
19. **M. Vincenzi** et al., *The Dark Energy Survey Supernova Program: cosmological analysis, systematic uncertainties, and validation*, (expected 2023).
    - Leading the analysis and curating the paper writing;
20. R. Hounsel, M. Sako, **M. Vincenzi**, et al., *Core collapse SN templates from the Dark Energy Survey*, (expected 2023).
    - Run all the simulations needed in the analysis, and tested the agreement between simulations and data;
21. B. Popovic, D. Scolnic, **M. Vincenzi**, et al., *Pasdronomy: Cosmological constraints from the joint SDSS+PS1 photometric sample*, (expected 2023).
    - Provided simulations for contamination and support for the implementation of classifiers and various steps of the analysis.