

ANNA CABRÉ

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APPOINTMENTS

- **Postdoctoral Inv and Research Associate in Oceanography and Climate** October 2012 - present
Department of Earth and Environmental Science
University of Pennsylvania, Philadelphia, PA
Supervisor: Prof. Irina Marinov
Webpage: <https://climate.sas.upenn.edu/node/15>
- *Projects: large-scale physical oceanography, biogeochemical cycles, phytoplankton models, and climate change.*
- **Postdoctoral Investigator in Cosmology** October 2009 – September 2012
Department of Physics and Astronomy
University of Pennsylvania, Philadelphia, PA
Supervisor: Prof. Bhuvnesh Jain
Webpage: <http://www.sas.upenn.edu/~cabre/>
- *Projects: large-scale measurements of gravitational weak lensing via cross-correlation techniques, dynamics of galaxies and clusters of galaxies, modified gravity, development of large simulations for the Dark Energy Survey.*
- **Postdoctoral Investigator in Cosmology** July 2008 - September 2009
Department of Cosmology and Extragalactic Astronomy
Institute of Space Sciences (IEEC-CSIC), Barcelona, Spain
Supervisor: Prof. Enrique Gaztañaga
- *Projects: cross-correlation of redshift (3D) and angular (2D) surveys, weak lensing detection, baryon acoustic peak detection.*

EDUCATION

- **Ph.D. in Physics** January 2004 - June 2008
University of Barcelona, Barcelona, Spain
Thesis Title: "Large scale structure and dark energy"
Supervisor: Dr. Enrique Gaztañaga
- *Summary: Study of the Universe growth of structure and dark energy evolution in the Sloan Digital Sky Survey via a) Integrated Sachs-Wolfe effect (correlation between distant cosmic microwave background and nearby galaxy surveys) and b) redshift space distortions.*

• **Master's Degree in Teaching Secondary Level Science**

September 2006 - May 2007

University of Barcelona, Barcelona, Spain

• **Master's Degree in Astrophysics**

January 2004 - September 2005

University of Barcelona, Barcelona, Spain

Thesis Title: "Integrated Sachs Wolfe effect in the Sloan Digital Sky Survey"

Supervisor: Dr. Enrique Gaztañaga

• **Bachelor's Degree in Physics**

September 1998 - July 2003

University of Barcelona, Barcelona, Spain

RESEARCH EXPERIENCE

Oceanography and Earth climate (shift in career path 2012-present):

• **Large-scale patterns of phytoplankton growth:** Earth System Model Intercomparison of phytoplankton types and growth in *Cabré, Marinov, Leung* (2015), patterns of phytoplankton change during the 21st century in the Southern Ocean across Earth System Models models in *Leung, Cabré and Marinov* (accepted), phytoplankton size classes retrieved via ocean color estimates (*Kostadinov et al.* in review), seasonality and trends in phytoplankton size classes retrieved from satellite data (in preparation), organic matter degradation (*Burd et al.*, 2015), theoretical links between size structure and organic matter flux.

• **Oxygen minimum zones in the Pacific Ocean** (*Cabré et al.* 2015)

• **Southern Ocean physics:** deep water formation and propagation of biogeochemical properties across Earth System Models, Weddell Sea open-ocean mixing (causes, processes, and atmospheric and oceanic teleconnections to the rest of the Earth).

Cosmology, Extragalactic Astronomy, and theoretical Physics (2004-2012):

• **New statistical strategies to analyse large datasets combining theory and observations:** cross-correlation techniques in *Cabré et al.* (2006), growth of structure in 3D space in *Cabré and Gaztañaga* (2009 I) and *Cabré and Gaztañaga* (2009 II), higher-order statistics in *Gaztañaga, Cabré et al.* (2009 III), line-of-sight oscillations in *Gaztañaga, Cabré and Hui* (2009), multi-dimensional analysis using Monte Carlo Markov Chains in *Sánchez, Crocce, Cabré et al.* (2009), analysis of angular space in *Sánchez et al.* (2011), *Crocce, Gaztañaga, Cabré et al.* (2011), *Carnero et al.* (2012) and *Gaztañaga et al.* (2012), theoretical modifications to Einstein's theory of gravity at galaxy scales in *Cabré et al.* (2012) and *Vikram, Cabré et al.* (2013).

• **Implementation of theoretical frameworks for error estimation in cosmological detections:** *Cabré et al.* (2007), *Cabré and Gaztañaga* (2011), *Crocce, Cabré et al.* (2011), and *Ross et al.* (2011).

Visits to other institutions:

• Visiting Scholar in *Kavli Institute for Cosmological Physics* at the University of Chicago and Fermilab, Chicago, USA, March-June 2006 (Supervisor: Dr. Joshua Frieman). Summary: Design strategies to improve constraints on cosmological parameters by combining observational results.

• Visiting Scholar in *National Institute of Astrophysics, Optics and Electronics (INAOE)*, Puebla, Mexico, February 2006 (Supervisor: Dr. Enrique Gaztañaga). Summary: spatial auto-correlation of luminous red galaxies positions and velocities.

• Visiting scholar in the *Institute for Computational Cosmology (ICC)*, Durham, Great Britain, February - May 2005 (Supervisor: Dr. Carlton Baugh). Summary: Development of simulated catalogs to mimic real galaxy surveys.

Computing experience:

• Management of large datasets, development of statistical tools, participation in large international projects.

- Word Processors: Microsoft Office (Word, Excel, PowerPoint), LaTeX
- Operating Systems: Microsoft Windows, LINUX, UNIX
- Programming languages: Fortran, IDL, Matlab, UNIX, SuperMongo, HTML
- Oceanographic software: Ferret
- Astronomical software: HEALPIX, sql, HYPERZ

Membership:

- American Geophysical Union AGU (since 2012)
- European Geophysical Union EGU (since 2015)
- Dark Energy Survey DES (2006-2012)
- Physics of the Accelerated Universe PAU Survey (2009-2012)
- The Marenstrum Institut de Ciencies de l'Espai Simulations MICE project (2006-2012)

Other

- Chair of a session in the meeting 'Ocean Sciences 2016' focused on teleconnections originating in the Southern Ocean (Session ID 9498).
- Reviewer for the journal "Progress in Oceanography", 2015
- Regular reviewer for the prestigious physics journal "Monthly Notices of the Royal Astronomical Society", 2008 - 2013
- Trained in machine learning by Stanford on-line course, September-December 2011

COLLABORATORS

Oceanography: Irina Marinov (U. Pennsylvania), Raffaele Bernardello (U. Southampton), Daniele Bianchi (U. Washington), Tihomir Kostadinov (U. Richmond), Anand Gnanadesikan (John Hopkins U.), Jamie Palter (McGill U.), Eric Galbraith (McGill U. moving to ICTA, Barcelona), Shirley Leung (U. of Washington)

Cosmology: Enrique Gaztañaga (IEEC), Bhuvnesh Jain (U. Pennsylvania), Pablo Fosalba (IEEC), Martin Crocce (IEEC), Marc Manera (U. College London), Lam Hui (NYU), Gary Bernstein (U. Pennsylvania), Vinu Vikram (U. Pennsylvania)

TEACHING

• Teaching assistant for undergraduate senior level class ENV5312 *Ocean Atmosphere Dynamics*, University of Pennsylvania, Philadelphia, USA, 2012 & 2013.

Responsible for grading, lab preparation and realization, homework, occasional lectures.

• Co-supervised 7 undergraduate students (Shirley Leung, Hyejung Lee, Lingbin Cai, Mo Green, Ryan Dungee, David Shields, and Danica Fine), two master students (Karan Sharma, Raghavendra Prasad), and one PhD student (Priya Sharma) in the Dept. of Earth and Environmental Science, University of Pennsylvania, Philadelphia, USA, 2012-2015. Projects: oxygen minimum zones, phytoplankton modeling, size structure from space, modeling Southern Ocean ecology, Antarctic deep water formation.

• Co-supervised a graduate student (Joseph Clampitt) in the Dept. of Physics and Astronomy, University of Pennsylvania, Philadelphia, USA, 2011. Projects: Retrieval of cosmological parameters from weak lensing in the Dark Energy Survey.

• Invited lecture for the class ENV5 204 "Global Climate Change" at Univ. of Pennsylvania, 2015

• Selected to attend the workshop 'Preparing for an Academic Career in Geosciences' part of the program 'On the Cutting Edge' organized by the 'National Association of Geoscience Teachers', 2015

• Attended a 'Teaching Science Seminar' organized by the 'Center for teaching & learning' at Univ. of Pennsylvania, 2014

• Secondary school support science teacher (4 hours per week), Sadako school, Barcelona, Spain, 1999-2001

GRANTS AND FUNDING

Funded by:

- *Ocean algae: evolution under future climate change*. University Research Foundation (URF) (9/2013 - 9/2014)
- *Seasonal, Interannual and Interdecadal Variability in Global Phytoplankton Community Size Structure Derived From Ocean Color Remote Sensing and IPCC-Class Ecosystem Models*. NASA grant NNX13AC92G under NASA ROSES 2012: Ocean Biology and Biogeochemistry (2/2013 - present)

Grants:

- Grant to participate in the course *Cornell Satellite Remote Sensing Training Program* at the University of Cornell, NY, USA, June 2014, awarded by the OCB program (Ocean Carbon & Biogeochemistry).
- Research travel grant to study at Kavli Institute for Cosmological Physics at the University of Chicago and Fermilab, Chicago, USA, March - June 2006, awarded by the Government of Catalonia.
- Research travel grant to study at INAOE: National Institute of Astrophysics, Optics and Electronics, Puebla, Mexico, February 2006, awarded by LENAC (Latin-American European Network for Astrophysics and Cosmology).
- Research travel grant to study at Institute for Computational Cosmology, Durham, Great Britain, February - May 2005, awarded by the Government of Catalonia.
- Ph.D. thesis grant, 2004-2007, awarded by the Government of Catalonia, Spain.
- Awarded grant to cover 1st year college tuition (highly competitive grant awarded to 5% of the incoming class), University of Barcelona, 1998-1999.

COURSES ATTENDED

- *Cornell Satellite Remote Sensing Training Program* at the University of Cornell, Ithaca, USA, June 2014
- Selected to attend the workshop 'Preparing for an Academic Career in Geosciences' part of Program 'On the Cutting Edge' (<http://serc.carleton.edu/NAGTWorkshops/careerprep2015/index.html>)

LIST OF PUBLICATIONS (1001 citations excluding self-citations via Google Scholar)

PUBLICATIONS IN REVIEW in OCEANOGRAPHY (1)

1. *Carbon-Based Phytoplankton Size Classes Retrieved via Ocean Color Estimates of the Particle Size Distribution*, Kostadinov, Milutinovic, Marinov, and **Cabr e**, in review for Ocean Science.
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PUBLICATIONS REFEREED (21)

Oceanography and climate variability:

21. *A Zonally-Banded Phytoplankton Response to 21st Century Climate Change in the Southern Ocean across the IPCC AR5 Earth System Model Suite*, Leung, **Cabr e**, and Marinov, accepted for publication in Biogeosciences.
20. *Oxygen Minimum Zones in the tropical Pacific across CMIP5 models: Mean State Differences and Climate Change Trends*, **Cabr e**, Marinov, Bernardello, and Bianchi, 2015, Biogeosciences, 12, 5429-5454

19. *Terrestrial and Marine Perspectives on Modeling Organic Matter Degradation Pathways*, Burd, Frey, **Cabré**, et al., 2015, *Global Change Biology*, 1365-2486

18. *Consistent global responses of marine ecosystems to future climate change across the IPCC AR5 Earth System Models*, **Cabré**, Marinov, and Leung, 2015, *Climate Dynamics*, 45, 5, 1253-1280

Cosmology and astrophysics:

17. *Searching for modified gravity in dwarf galaxies*, Vikram, **Cabré**, Jain and VanderPlas, 2013, *JCAP*, 8, 20

16. *Astrophysical tests of gravity: a screening map of the nearby universe*, **Cabré**, Vikram, Zhao, Jain, Koyama, 2012, *JCAP*, 7, 34

15. *Cross-correlation of spectroscopic and photometric galaxy surveys: cosmology from lensing and redshift distortions*, Gaztañaga et al, 2012, *MNRAS*, 422, 2904

14. *Clustering of photometric luminous red galaxies - II. Cosmological implications from the baryon acoustic scale*,

Carnero, Sánchez, Crocce, **Cabré** and Gaztañaga, 2012, *MNRAS*, 419, 1689

13. *Clustering of photometric luminous red galaxies - I. Growth of structure and baryon acoustic feature*, Crocce, Gaztañaga, **Cabré**, Carnero and Sánchez, 2011, *MNRAS*, 417, 2577

12. *Measuring redshift-space distortions using photometric surveys*, Ross, Percival, Crocce, **Cabré** and Gaztañaga, 2011, *MNRAS*, 415, 2193

11. *Modelling the angular correlation function and its full covariance in photometric galaxy surveys*, Crocce, **Cabré** and Gaztañaga, 2011, *MNRAS*, 414, 329

10. *Have Baryonic Acoustic Oscillations in the galaxy distribution really been measured?* **Cabré** and Gaztañaga, *MNRAS*, 412, 98

9. *Tracing The Sound Horizon Scale With Photometric Redshift Surveys*, Sánchez et al, 2011, *MNRAS*, 411, 277

8. *Cosmological parameter constraints from SDSS luminous red galaxies: a new treatment of large-scale clustering*, Sánchez, Crocce, **Cabré**, Baugh and Gaztañaga, 2009, *MNRAS*, 400, 1643

7. *Clustering of Luminous Red Galaxies IV: Baryon Acoustic Peak in the Line-of-Sight Direction and a Direct Measurement of $H(z)$* , Gaztañaga, **Cabré** and Hui, 2009, *MNRAS*, 399, 1663

6. *Clustering of Luminous Red Galaxies III: Detection of the Baryon Acoustic Peak in the 3-point Correlation Function*, Gaztañaga, **Cabré**, Castander, Crocce and Fosalba, 2009, *MNRAS*, 399, 801

5. *Clustering of luminous red galaxies II: small scale redshift space distortions*, **Cabré** and Gaztañaga, 2009, *MNRAS*, 396, 1119

4. *Clustering of luminous red galaxies I: large scale redshift space distortions*, **Cabré** and Gaztañaga, 2009, *MNRAS*, 393, 1183

3. *Error analysis in cross-correlation of sky maps: application to the ISW detection*, **Cabré**, Fosalba, Gaztañaga and Manera, 2007, *MNRAS*, 381, 1347

2. *Evidence for dark energy: cross-correlating SDSS5 and WMAP3*, **Cabré**, Gaztañaga, Manera, Fosalba and Castander, 2007, *ASPC*, 379, 283

1. *Cross-correlation of WMAP3 and SDSS DR4: new evidence for dark energy*, **Cabré**, Gaztañaga, Manera, Fosalba and Castander, 2006, *MNRAS*, 372, 23

PUBLICATIONS IN PREPARATION in OCEANOGRAPHY (4)

4. *Inter-Comparison of Phenological Parameters Derived From Different Ocean Color Phytoplankton Functional Types Algorithms* (with Kostadinov and Marinov).

3. *Decadal climate oscillations driven by Southern Ocean open-ocean convection* (with Marinov and Gnanadesikan)

2. *Phenology of phytoplankton functional types from Satellite Ocean color observations* (with Marinov and Kostadinov).

1. *Ocean carbon and oxygen cycling: implications of a climate-driven slowdown in Southern Ocean deep-water formation* (with Marinov).

SCIENCE OUTREACH

- Regular blogger to Spanish online journal *Investigación y Ciencia* (<http://www.investigacionyciencia.es/>), Spanish edition of *Scientific American*, since May 2014.
- Invited talk: *The role of oceans in mitigating the impact of climate change*, Delaware State University (NASA Innovations in Climate Education, NICE), Dover, Delaware USA, March 2014
- Regular contributor to Spanish newspaper ‘Última Hora’ with popular science articles, 2009-2011.
- Outreach for general public in science fiction, nature and mathematics, at public libraries of Barcelona, Spain, 2007-2009
- Trained in science journalism with a course at the prestigious newspaper ‘El País’, Madrid, Spain, July 2006.
- Outreach for children in popular science in primary schools, Barcelona, Spain, 2004-2009.

SCHOLARLY PRESENTATIONS

- *Southern Ocean open-ocean convection teleconnections* (poster), EGU meeting, Vienna, Austria, April 2015
- *21st century projections of ocean ecology and productivity across the CMIP5 models: contrasting the Southern Ocean and the Arctic* (talk), AGU fall meeting, San Francisco, USA, December 2014
- *Response of phytoplankton to climate change in the Southern Ocean: an IPCC AR5 Earth System Model Intercomparison* (talk), IMBER meeting, Bergen, Norway, June 2014
- *Phytoplankton productivity response to 21st century climate change across the CMIP5 models suite* (poster), NASA Ocean Color Research Team Meeting, Silver Spring, Maryland USA, May 2014
- *Consistent global responses of marine ecosystems to future climate change across the IPCC AR5 Earth System Models* (talk), Sayre Hall seminar series, Princeton, New Jersey USA, April 2014
- *Consistent global responses of marine ecosystems to future climate change across the IPCC AR5 Earth System Models* (talk), Ocean Sciences meeting, Honolulu, Hawaii USA, February 2014
- *Oxygen minimum zones across CMIP5 models in the tropical Pacific* (poster), Ocean Sciences meeting, Honolulu, Hawaii USA, February 2014
- *Response of phytoplankton to climate change in the Southern Ocean: an IPCC AR5 Earth System Model Intercomparison* (talk), Key uncertainties in the global carbon-cycle, Boulder, Colorado USA, August 2013
- *Response of ocean ecology to climate change in the Southern Ocean: an IPCC AR5 Earth System Model Intercomparison* (talk), Impact of climate change on marine ecosystems, Paris, France, March 2013
- *Response of ocean ecology to climate change: an initial IPCC AR5 Earth System Model Intercomparison* (talk), AGU fall meeting, San Francisco, USA, December 2012
- *North-South Asymmetry in the Response of phytoplankton to climate change: an IPCC AR5 Earth System Model Intercomparison* (talk), C-SOBOM collaboration meeting (<http://sobom.princeton.edu/>), Princeton University, Princeton, USA, October 2012
- *Response of phytoplankton to climate change in the Northern vs the Southern Hemisphere: an IPCC AR5 Earth System Model Intercomparison* (poster), OCB Workshop, Woods Hole, USA, July 2012
- *The Response of ocean ecology to climate change in the IPCC AR5 Earth System Models* (talk), Dept Earth Science, University of Pennsylvania, Philadelphia, USA, April 2012

- *Modified gravity screening mechanisms in SDSS* (talk), East Coast Gravity Meeting, Syracuse University, Syracuse, USA, April 2012
- *The response of ocean ecology to climate change: an IPCC AR5 Earth System Model inter-comparison* (collaborated in work, talk by Irina Marinov), TOS/ASLO/AGU Ocean Sciences Conference, Salt Lake City, USA, February 2012.
- *Magnification by cross-correlating number counts at different redshift slices* (talk), Dark Energy Survey (DES) collaboration meeting, Dept. of Physics, University of Pennsylvania, Philadelphia (USA), October 2011
- *Modified gravity in dwarf galaxies* (talk), DES collaboration meeting, Institute of Cosmology and Gravitation, Portsmouth (Great Britain), July 2011
- *Dark Energy Survey weak lensing testing* (talk), DES collaboration meeting, Fermilab, Chicago, USA, October 2010
- *Halo masses from the Dark Energy Survey and Spectroscopic Surveys* (talk), 10 years of Cosmic shear, The Royal Observatory, Edinburgh, Great Britain, July 2010
- *Dynamics of satellites around clusters* (talk), Great Lakes conference, Dept of Physics at University of Chicago, USA, June 2010
- *Luminous red galaxies correlation function at small scales* (talk), DES collaboration meeting, Center for Research in Energy, Environment and Technology (CIEMAT), Madrid, Spain, May 2010
- *Angular Clustering in DES* (talk), DES collaboration meeting, SLAC National Accelerator Laboratory, Stanford, USA, December 2009
- *Radial baryon acoustic oscillation detection in Sloan Digital Sky Survey* (talk), DES collaboration meeting, Brazilian Center for Physics, Rio de Janeiro, Brazil, May 2009
- *Integrated Sachs-Wolfe effect using SDSS DR5 data* (talk), VII Scientific Meeting of Spanish Astronomy Association, University of Barcelona, Barcelona, Spain, September 2006
- *Error analysis for Integrated Sachs-Wolfe effect* (talk), Cosmic Frontiers, Institute for Computational Cosmology, Durham, Great Britain, July 2006
- *Cross-correlations between large-scale structure and WMAP* (talk), Fermilab, Chicago, USA, May 2006
- *Constructing mock surveys from semi-analytical simulations*, Seminar talk, Institute for Computational Cosmology, Durham, Great Britain, April 2005
- International summer school: Data Analysis in Cosmology, Valencia, Spain, September 2004
- *Cross-correlating CMB with SDSS* (poster), 20th Colloquium on CMB physics and observation, Paris, France, June 2004