

Alexander Mead

curriculum vitae

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curriculum vitae

Academic appointments

- 2017 – 2020 **Marie Skłodowska Curie Fellowship**, *weak lensing*, University of Barcelona and University of British Columbia, Licia Verde and Ludovic van Waerbeke.
- 2015 – 2017 **Canadian Institute of Theoretical Astrophysics (CITA) National Fellowship**, *weak lensing*, University of British Columbia, Ludovic van Waerbeke.
- 2014 – 2015 **Post-doctoral fellow**, *baryonic feedback, matter clustering, weak lensing*, University of Edinburgh, Catherine Heymans.

Education

- 2010 – 2014 **PhD**, *Cosmological structure formation*, University of Edinburgh, John Peacock.
- 2005 – 2010 **MPhys**, *University of Oxford, 1st class, Millard Exhibition, Trinity scholarship*.

Awards

- 2016 **Marie Skłodowska Curie Fellowship**, *UBC and Barcelona*.
- 2015 **CITA National Fellowship**, *UBC and CITA*.
- 2010 **STFC funded PhD position**, *Edinburgh*.
- 2010 **Peter Fisher prize**, *top results in college, Oxford*.
- 2009 **Trinity College Scholarship**, *1st class results in exams, Oxford*.
- 2008 **Millard Exhibition**, *general high standard of academic work, Oxford*.

PhD thesis

- title *Demographics of dark-matter haloes in standard and non-standard cosmologies*
- supervisors John Peacock, Alan Heavens, Sylvain de la Torre, Lucas Lombriser
- description (1) Tuning the halo model of structure formation to accurately predict the full non-linear matter power spectrum as a function of cosmological parameters. (2) Rescaling cosmological simulations, in terms of both matter distributions and halo catalogues, between cosmological models. (3) Rescaling simulations from standard to modified gravity models.

Research interests

- Cosmology** I have a strong background in fundamental cosmology with particular knowledge of the theory of structure formation including both the perturbative and non-linear regime via the halo model. I am interested in how the halo model can be extended to better model the statistical properties of the density field when considering dark energy (DE) and modified gravity (MG) scenarios and accounting for baryons.
- Simulations** As well as having written my own cosmological simulation code (PM) I am experienced in using `GADGET-2` to perform cutting-edge, multi-core simulations. I have modified `GADGET-2` to include a dark energy component and I am interested in simulations of both DE and MG models, but particularly in how to *avoid* running large numbers of simulations by applying better theoretical modelling to simulation output, particularly by rescaling between different cosmological models. Over the course of my PhD I developed a large library of software to analyse the output of simulations and to generate and analyse halo catalogues produced by simulations.
- Orbits** I enjoy the theory behind celestial mechanics. I find it particularly fascinating how orbits can be modified over secular timescales by the accumulation of small perturbations and also how day-night cycles and climate would vary on planets with orbital parameters different from that of the earth. To this end I have written a direct particle-particle n -body code to perform accurate calculations of orbital motions. I have used this to investigate how flux patterns would vary on planets in non-standard orbital configurations including spin-orbit resonance, Lagrange point orbits and planets orbiting a binary.

Publications - lead author

I am first author of 6 papers. I have a first-author h -index of 4:

1. A. J. Mead. "Spherical collapse, formation hysteresis and the deeply non-linear cosmological power spectrum". In: *MNRAS* 464 (Jan. 2017). DOI: 10.1093/mnras/stw2312. arXiv: 1606.05345 (2 citations)
2. A. J. Mead et al. "Accurate halo-model matter power spectra with dark energy, massive neutrinos and modified gravitational forces". In: *MNRAS* 459 (June 2016). DOI: 10.1093/mnras/stw681. arXiv: 1602.02154 (18 citations)
3. A. J. Mead et al. "An accurate halo model for fitting non-linear cosmological power spectra and baryonic feedback models". In: *MNRAS* 454 (Dec. 2015). DOI: 10.1093/mnras/stv2036. arXiv: 1505.07833 (41 citations)
4. A. J. Mead et al. "Rapid simulation rescaling from standard to modified gravity models". In: *MNRAS* 452 (Oct. 2015). DOI: 10.1093/mnras/stv1484. arXiv: 1412.5195 (11 citations)
5. A. J. Mead and J. A. Peacock. "Remapping simulated halo catalogues in redshift space". In: *MNRAS* 445 (Dec. 2014). DOI: 10.1093/mnras/stu1964. arXiv: 1408.1047 (3 citations)
6. A. J. Mead and J. A. Peacock. "Remapping dark matter halo catalogues between cosmological simulations". In: *MNRAS* 440 (May 2014). DOI: 10.1093/mnras/stu345. arXiv: 1308.5183 (11 citations)

Publications - significant contribution

1. S. Joudaki et al. "CFHTLenS revisited: assessing concordance with Planck including astrophysical systematics". In: *ArXiv e-prints* (Jan. 2016). arXiv: 1601.05786
2. L. Lombriser, F. Simpson, and A. Mead. "Unscreening Modified Gravity in the Matter Power Spectrum". In: *Physical Review Letters* 114.25, 251101 (June 2015). DOI: 10.1103/PhysRevLett.114.251101. arXiv: 1501.04961 (5 citations)
3. D. H. Forgan et al. "Surface flux patterns on planets in circumbinary systems and potential for photosynthesis". In: *International Journal of Astrobiology* 14 (July 2015). DOI: 10.1017/S147355041400041X. arXiv: 1408.5277 [astro-ph.EP] (0 citations)
4. S. P. Brown et al. "Photosynthetic potential of planets in 3:2 spin-orbit resonances". In: *International Journal of Astrobiology* 13 (Oct. 2014). DOI: 10.1017/S1473550414000068. arXiv: 1402.5044 [astro-ph.EP] (2 citations)

Publications - less significant contribution

1. H. Hildebrandt et al. "KiDS-450: Cosmological parameter constraints from tomographic weak gravitational lensing". In: *ArXiv e-prints* (June 2016). arXiv: 1606.05338
2. A. Lawrence et al. "Slow blue nuclear hypervariables in PanSTARRS-1". In: *ArXiv e-prints* (May 2016). arXiv: 1605.07842 [astro-ph.HE]
3. M. Nicholl et al. "Superluminous supernovae from PESSTO". in: *MNRAS* 444 (Nov. 2014). DOI: 10.1093/mnras/stu1579. arXiv: 1405.1325 [astro-ph.HE] (22 citations)

Software

I currently maintain or contribute heavily to the following publicly available software:

1. A. Mead. *HMcode: Halo-model matter power spectrum computation*. Astrophysics Source Code Library. Aug. 2015. ascl: 1508.001
2. A. Lewis and A. Challinor. *CAMB: Code for Anisotropies in the Microwave Background*. Astrophysics Source Code Library. Feb. 2011. ascl: 1102.026

Computer skills

OS Linux, OS X

Coding FORTRAN, C, python, gnuplot

Simulations GADGET-2, N-GENIC, 2LPTIC, halo finding, simulation analysis tools

Academic talks

2017 Intermediate dark energy – *cosmology discussion group, UBC*

2017 Formation hysteresis in cosmology – *colloquium, CITA*

2017 Formation hysteresis in cosmology – *cosmology discussion group, UBC*

2016 Non-linear cosmological structure formation – *theory seminar, TRIUMF*

2016 Non-linear cosmological structure formation – *colloquium, LIneA*

- 2016 Non-linear cosmological structure formation – *colloquium, UBC*
- 2016 Non-linear cosmological structure formation – *colloquium, CITA*
- 2016 The halo model – *cosmology discussion group, UBC*
- 2016 HMcode – *gravity meeting, Vancouver*
- 2015 Rescaling simulations from standard to modified gravity – *DEX meeting, ROE*
- 2014 Rescaling simulations from standard to modified gravity – *University of Oxford*
- 2014 Rescaling simulations from standard to modified gravity – *McGill University*
- 2014 Central configuration solutions to the n-body problem – *ROE short talk*
- 2014 Rescaling simulations from standard to modified gravity – *Benasque workshop*
- 2014 Rescaling in redshift space – *UCL cross correlations workshop*
- 2014 Rescaling simulations from standard to modified gravity – *Higgs workshop*
- 2013 Rescaling dark matter halo catalogues – *ROE internal seminar*
- 2013 Life in 3-2 spin-orbit resonance – *ROE short talk*
- 2012 Halofit 2 – *DEX meeting*
- 2012 Halofit 2 – *Benasque workshop*
- 2012 Halofit 2 – *Passo Tonale winter school*

Outreach

- 2013–2015 The distant Universe – *Course of ten public lectures, given each year for three years*
- 2014 Dark energy – *Talk given to the Edinburgh astronomical society*
- 2012–2013 Progress in astronomy lectures – *Public talks given every month on new discoveries*
- 2013 Mass transfer in binary stars – *ROE public lecture*
- 2012 Large-scale structure formation – *ROE public lecture*

Teaching

- 2017 Galaxies - lecture cover at UBC
- 2016 Cosmology - lecture cover at UBC
- 2015 The binary orbit menagerie – Summer undergraduate student project
- 2015 Planetary orbits in Lagrange points – Summer undergraduate student project
- 2014 – 2015 The effect of dark energy on cosmological structure formation – Masters student project
- 2014 Planetary systems perturbed by passing stars – Summer undergraduate student project
- 2013 – 2015 The distant Universe – Course of public lectures
- 2012 – 2013 General relativity – Undergraduate teaching
- 2010 – 2013 Cosmology – Undergraduate teaching
- 2010 – 2011 Mathematical physics – Undergraduate teaching

■ Involvement in academic institutions

- 2016 – 2017 Organiser of the UBC cosmology reading group
- 2012 – 2015 Organiser of the Edinburgh large-scale structure reading group

■ Referees

- 1 Professor John Peacock – *jap@roe.ac.uk*
- 2 Professor Catherine Heymans – *cech@roe.ac.uk*
- 3 Professor Ludovic van Waerbeke – *waerbeke@phas.ubc.ca*