

MATTEO VIEL

Date of birth: September 5, 1975 **Place of birth:** Udine (Italy)

Nationality: Italian

Contact details:

SISSA - Scuola Internazionale Studi Superiori Avanzati
via Bonomea 265
I-34136 Trieste, Italy
tel. +39-040-3787517
fax. +39-040-3787249
e-mail: viel@sissa.it - matteoviel@gmail.com
web-page: <http://www.sissa.it/~viel>
group web-page: <http://www.sissa.it/~viel/cosmoIGM/>

Curriculum vitae

- **1999: Degree in Physics**, Università di Padova, Italy. Thesis: “A merger tree for the formation of cosmic structures” Thesis supervisors: Prof. Sabino Matarrese, Prof. Giuseppe Tormen. (grade: full mark 110/110 cum laude)
- **9/1999 - 3/2000:** Fellowship of Università di Padova for a period of six months at Max-Planck-Institut für Astrophysik (Garching, Germany)
- **11/1999 - 11/2002:** PhD position at the Physics Department of Università di Padova (Italy)
- **02/2001 - 04/2001:** Visiting period at Max-Planck-Institut für Astrophysik (Garching, Germany)
- **04/2001 - 10/2001:** EARA-Marie Curie Fellowship at Max-Planck-Institut für Astrophysik (Garching, Germany)
- **02/2002 - 07/2002:** EARA-Marie Curie Fellowship at Institute of Astronomy (Cambridge, UK)
- **11/2002 - 10/2003: Research Associate** - Institute of Astronomy (Cambridge, UK)
- **02/2003: PhD from Università di Padova** (Italy), Thesis “Numerical Models of the Intergalactic Medium” - Thesis supervisor: Prof. Sabino Matarrese

- **10/2003 - 10/2006: Research Associate** - PPARC (Particle Physics Astronomy Research Council) fellowship, Institute of Astronomy (Cambridge, UK)
- **11/2004 - 12/2004:** Visiting period at KAVLI institute (Santa Barbara) for the program Galaxies-Intergalactic Medium interaction
- **10/2004 - 10/2006:** Research Fellow Clare Hall College (Cambridge, UK)
- **10/2005 - 12/2005:** Researcher **staff position at Trieste Observatory** (INAF-OATS)
- **10/2006 - present:** Affiliated to **INFN** (Italian National Institute of Nuclear Physics) - Scientific local coordinator of INFN CSN4 Specific Initiative PD51- INDARK: Fisica Astro-Particellare: Inflazione, materia oscura e struttura su grande scala dell'Universo (since 2011)
- **July 2009:** visiting scientist at the IoA, Cambridge (UK)
- **Dec 2010 - Dec 2016: Winner of the European Research Council - Starting/Consolidator Grant (ERC-StG) cosmoIGM - The Intergalactic Medium as a Cosmological Tool**
- Grant period 01/12/14-01/12/16
- **August 2010:** Member of Consiglio Docenti and Affiliated Staff of the **Astroparticle Sector at SISSA** <http://www.sissa.it/app/>
- **July 2011:** elected as a member of INAF Comitato di Macroarea-1: Galassie e Cosmologia
- **Oct 2012:** elected as a member of the Time Allocation Committee (TAC) for the Italian telescopes TNG/LBT/REM (for 2 years)
- **Dec 2016 - now: Associate Professor in the Astroparticle Sector at SISSA.**

Research Interests

My research focusses on the use of the **large scale structure as a cosmological probe**. In particular, I have investigated the so-called mildly non-linear scales, especially in the **high redshift universe**, as probed by different observables. These scales allow to constrain the cosmological model and put constraints of fundamental properties such as **neutrino masses** and the **coldness of cold dark matter**. I have also made a comprehensive analysis of baryons from high to low redshift addressing the **galaxy-intergalactic medium interplay**. Here below I summarize in more details my main research interests.

- **The Intergalactic Medium/IGM** - Investigation of the Lyman- α forest, which is the main manifestation of the intergalactic medium, as a cosmological tool to probe the: 1) growth of cosmic structure; 2) fundamental physics; 3) the galaxy-IGM interplay. Constraints on the thermal history and metal enrichment of the Intergalactic Medium. Thermal, dynamical and chemical properties of the IGM. Reionization of the universe and evolution and nature of the Ionizing Background. Impact of galactic winds on the IGM. Low redshift IGM. Reionization. Impact of galactic winds and black hole feedback on galaxy evolution and on the IGM. Metal enrichment mechanisms in the high redshift universe. Absorption lines properties using high (UVES), medium (X-Shooter) and low (BOSS) resolution spectrographs. 21 cm intensity mapping as a cosmological observable in the post-reionization era.
- **Fundamental physics** - Nature of dark matter and its impact on the large, medium and small scale structure of the Universe. Constraints on the coldness of cold dark matter and warm dark matter models. Full characterization of cosmological massive neutrinos in the linear and non-linear regime. Constraints on sterile neutrino particles using the Lyman- α forest. Measuring the cosmic expansion using the Lyman- α forest with the ESO-ELT (Extremely Large Telescope). Constraints on inflationary models and primordial non gaussianity using the IGM.
- **Cosmological parameters** - Recovery of cosmological parameters and properties of the dark matter density field in standard and non-standard cosmological models. Quantitative measurements of dark energy, warm dark matter, neutrinos properties. Early dark energy models. Cross-correlation of large scale structure data (SDSS galaxies and quasars, Fermi sources and diffuse signal, NVSS, 2MASS, etc.) and cosmic microwave background (Planck, WMAP) data. Multi dimensional likelihood estimation of cosmological parameters using Monte Carlo Markov Chains. Cosmic degeneracies (e.g. neutrinos and modified gravity).
- **Structure formation using High Performance Computing Facilities** - Hydrodynamic and N-body codes. Evolution of cosmic structures in the high redshift universe. Density profiles of dark matter halos. Comparison of SPH and Eulerian codes for the physics of the IGM and the large scale structure. Use of international parallel super computer (COSMOS, HPCS in Cambridge (UK) and CINECA (Italy) in particular) to simulate the Universe at different scales. Coupled and early dark energy, modified gravity models and the impact on the Medium Scale Structure and IGM. Neutrino and warm dark matter simulations.

Teaching

- Supervisor, Part III Physics Gravitational Astrophysics and Cosmology a course held by Professors Lasenby, Fabian, Rees and Hobson (Physics Department - University of Cambridge) (years 2003-04)
- Supervisor, Part III Maths Physical Cosmology”, a course held by Prof. Pettini and Dr. Weller (DAMTP - University of Cambridge) (years 2005-06)
- Lectures at Beijing Normal University (China) on the Physics of the Intergalactic Medium 10 hrs course (October 2006)
- Lecturer at Università La Sapienza, Cosmology course for PhD students Intergalactic Medium Cosmology, 2007, 12 hrs course
- Lecturer at SISSA (Trieste) Structure formation for PhD students, during years 2009, 2010, 2011 12 hrs course
- 2011: 20hrs lecturing at Università degli Studi di Trieste for the Cosmology course of Prof. Borgani
- 2011: 6hrs lecturing at Università degli Studi di Bologna for the PhD curriculum in Astronomy
- 2011: Lecturer at the PhD school on neutrinos organized by INFN in Padova
- 2012: 20hrs lecturing at University of Trieste (Cosmology course)
- 2012,2013,2014,2015,2016: 22hrs lecturing/seminars at SISSA for AP/APP PhD students “Structure Formation” course
- 2015,2016: 12 hrs lecturing at SISSA for APP PhD students “Foundation of Physical Cosmology” course

Conferences/Workshops/Schools Organized

- July 2004, Cambridge(UK) Institute of Astronomy, workshop Cosmology with Lyman- α ”
- NOVICOSMO 2008, Trieste October 2008, International conference: “The impact of Simulations in Cosmology and Galaxy Formation”
- ICTP (Trieste, Italy) Cosmology school 2010:
http://cdsagenda5.ictp.trieste.it/full_display.php?ida=a07163
- COSMOCOMP meeting in Trieste - LOC member
<http://adlibitum.oats.inaf.it/meetings/COSMOCOMPTS/>
- ICTP (Trieste, Italy) Cosmology school 2014:
http://cdsagenda5.ictp.it/full_display.php?email=0&ida=a13212

- ICTP (Trieste, Italy) Conference on Cosmology from baryons at high redshift
http://cdsagenda5.ictp.it/full_display.php?email=0&ida=a13215

- Sexten Center for Astrophysics - July 2015 “Galaxy Clustering within Euclid OULE3”
<http://www.sexten-cfa.eu/en/conferences/2015/details/57-galaxy-clustering-within-euclid-oule3.html>

- Sexten Center for Astrophysics - February 2016 “Astrophysics of Dark Matter”
<http://www.sexten-cfa.eu/en/conferences/2016/details/67-astrophysics-of-dark-matter.html>

- “F. Lucchin” Cosmology School for Italian PhD Students - May 2016 - Naples Astronomical Observatory <http://eventi.na.astro.it/en/scuola-lucchin/>

- Sexten Center for Astrophysics - July 2017 “Getting ready for science. Euclid Galaxy Clustering under Science Performance Review”
<http://www.sexten-cfa.eu/en/conferences/2017/details/81-getting-ready-for-science-euclid-galaxy-clustering-under-science-performance-review.html>

Outreach

- Physorg: <http://www.physorg.com/news76328087.html>
- ESI-TOPICS: Emerging Research Fronts Comments <http://www.esi-topics.com/erf/2006/october06-Matteo>
- FEST (Festival Editoria Scientifica Triestina) 2007 Trieste - Talk
- SPACE ART at immaginario scientifico Trieste - October 2008
- Telecom ItaliaX10: <http://italiax10.telecomitalia.com/news/intervista-a-matteo-viel/>
- Intervista a Radio 24: <http://www.radio24.ilsole24ore.com/programma/altra-europa/2013-09-28/partecip>
- On average 5/6 public talks per year

Main Collaborations

- **Euclid Deputy Lead** of theory Working Group, member Simulation Working Group; **Manager** of the OU-LE3 Organisational Units-Level 3 of Validation for Galaxy Clustering (together with Prof. Baugh in Durham)
- Member of the **SKA Cosmology Group** (since June 2014)
- Computational projects on european parallel supercomputers: COSMOS, HPCS-Darwin (Cambridge, UK); CINECA (Italy); Marenostrum (Barcelona, Spain). PRACE.
- Cambridge - UK (Institute of Astronomy); Garching - Germany (MPA, ESO), CERN (Switzerland), Padua University (Italy)
- X-Shooter instrument (medium resolution spectrograph) and WEAVE spectrograph.
- member of the **BOSS/SDSS-III** collaboration since April 2011.
- member of the light core team of Planck for a project to compute cross-correlation between CMB maps and the large-scale structure (since June 2011) ISW effect and constraints on non-gaussianities by using cross-correlation of LSS tracers and evolution of the Dark Energy and modified gravity.
- ESPRESSO and high res. spectrgraph instruments: high resolution spectrographs on the E-ELT (ESO - Extremely Large Telescope)

Citations

~ 11500 citations

~ 2000 as a first author

h-index = 48

first author h-index = 20

(Jan 2017: from NASA/ADS web site and INSPIRE)

Other Activities

Referee for Astronomy and Astrophysics, MNRAS, MNRAS Letters, Physical Review D, JCAP, Astrophysical Journal, Physical Review Letters. Referee for the NWO: Netherlands Organisation for Scientific Research. Referee for ANVUR.

Member of PhD evaluation committee: J. Brandbyge (Aarhus Univ.); M. Savalainen (Helsinki Univ.); C. Schultz (Aarhus Univ.); A. Arino (Barcelona Univ.), B. Audren (Lausanne Univ.), F. Villaescusa-Navarro (Valencia Univ.), J. Schewtschenko (Durham Univ.).

Students and Postdocs

- University Degree Students: Matteo Costanzi (2011, Università di Trieste, co-supervision with Prof. Borgani); Alex Zucca (2014, Università di Trieste, co-supervision with Dr. Ansoldi e Silvestri); Simone Peirone (2016, Università di Trieste, co-supervision with Dr. Ansoldi and Prof. Borgani).
- PhD-Students: Edoardo Tescari (Thesis defended in April 2010) Chemical and Physical Properties of the Inter- galactic Medium (full supervision); Chiara Mongardi (to finish in Dec 2016 “The galaxy/IGM interplay”, co-supervision with Dr. D’Odorico); Elena Massara (SISSA/ICTP, to finish in Oct 2016, co-supervision with Prof. Sheth); Isabella Carucci (SISSA, to finish in Oct 2017, co-supervision with Dr. Lapi); Andrej Obuljen (SISSA, to finish in Oct 2018); Francesca Lepori (SISSA, to finish in Oct 2018); Riccardo Murgia (SISSA, to finish in Oct 2019).
- PhD-Students co-supervised: John Regan (2004-2007 Cambridge, UK), Jamie Bolton (2003-2006 Cambridge, UK), Antonella Garzilli (2009-2012 SISSA, Italia), Dunja Fabjan (2007-2010, Università di Trieste), Matteo Costanzi (2011- 2014, Università di Trieste, co-supervision with Prof. Borgani)
- Postdocs funded: Dr. Paramita Barai (cosmoIGM postdoc 2011-2014); Dr. Francisco Villaescusa-Navarro (cosmoIGM postdoc 2012-2016); Dr. Tae-Sun Kim (cosmoIGM postdoc 2013-2016); Dr. Enea Di Dio (cosmoIGM postdoc 2014-2017); Dr. Paul Sutter (INFN/INDARK in Trieste - postdoc 2014-2016)

Grants and funding

- **Member** of research unit of PRIN-MIUR 2007 The cosmic cycle of baryons P.I. Prof. S. Borgani (140 kE total grant)
- PRIN-INAF 2009 Towards an italian network of computational cosmology: 110 kE (4 research units, role **national P.I.** research project)
- ASI/AAE Grant 2006-2009 (Theory: High Energy Astrophysics) 60 kE for 3 yrs (role: **P.I. of the local research unit** at INAF-OATS (national P.I. Prof. Moscardini)
- **Member** of research unit of ITN (European Network) Computational Cosmology - COSMO-COMP: P.I. Prof. Baugh (Durham), local coordinator Prof. Borgani (Università di Trieste)
 - Trieste node 540 kE + 90 kE (da progetto LACEGAL) for students and researchers
- **Winner of ERC-StG (European Research Council - Starting Grants) with the 6yrs project cosmoIGM: the intergalactic medium as a cosmologica l tool (role: P.I.; amount: 891,500 Euros to cover the joining of the Sloan Digital Sky Survey-III/BOSS survey for the acoustic baryonic oscillations + 4 postdoctoral fellows + 50% of my salary)**
- PRIN INAF 2011 “A complete view of the first years of galaxy formation” (National P.I. A. Fontana), **local P.I. of research unit** 10 kE.
- PRIN MIUR 2012 “Evoluzione dei barioni cosmici: effetti astrofisici e crescita delle strutture cosmiche” (national P.I. Prof. Borgani) - 270 kE total, **member of research unit**
- **Scientific local coordinator** of research specific initiative **INFN-PD51 INDARK** (funding about 10kE/yr + one 40kE two-year postdoctoral fellowship in 2014)

Funds directly administrated: 891.5 kE (ERC-StG)+ 60 kE (ASI/AAE) + 110 kE (PRIN-INAF) + 10 kE (PRIN INAF) + 60 kE (INFN) = 1.13 ME

Referees

Prof. Martin Haehnelt

Institute of Astronomy University of Cambridge
Madingley Road, Cambridge - CB3 0HA (UK) Tel: +44-1223-766671
Fax: +44-1223-337523 e-mail: haehnelt@ast.cam.ac.uk

Prof. Sabino Matarrese

Dipartimento di Fisica Galileo Galilei
via Marzolo, 8 - 35131 Padova (Italy)
phone : (+39) 049 8277120 fax: (+39) 049 8277112 e-mail: matarrese@pd.infn.it

Prof. Stefano Cristiani

INAF/Osservatorio Astronomico Di Trieste
Via Tiepolo 11, 34143 Trieste (Italy)
phone : +39 040 3199220 - fax: +39 040309418 e-mail: cristiani@oats.inaf.it

Prof. Julien Lesgourgues

Theory Division CERN & Aachen University
CH-1211 Geneva (Switzerland)
phone : (+41) 22 7672824 fax: (+41) 22 7673850 e-mail: Julien.Lesgourgues@cern.ch

Seminars

- 03/2001: Institute Seminar at MPA
- 03/2001: Cosmology Seminar at MPA
- 11/2001: Institute Seminar at Dipartimento di Astronomia di Padova (Italy)
- 11/2001: Cosmology Seminar at Osservatorio Astrofisico di Arcetri (Florence, Italy)
- 11/2001: Institute Seminar at Osservatorio Astronomico di Trieste (Italy)
- 11/2002: Institute Seminar at Institute of Astronomy Cambridge (UK)
- 09/2003: Institute Seminar at Osservatorio Astronomico di Trieste (Trieste, Italy)
- 10/2003: Institute Seminar at SISSA (Trieste, Italy)
- 10/2003: Institute Seminar at Dipartimento di Astronomia di Bologna (Bologna, Italy)
- 10/2003: Institute Seminar at Osservatorio Astronomico di Padova (Bologna, Italy)
- 03/2004: Institute Seminar at Department of Astronomy, University of Sussex (Brighton, UK)
- 11/2004: Cosmology Seminar at Department of Astronomy, University of Oxford (Oxford, UK)
- 11/2004: Lyman- α forest seminar, University of Berkeley (US)
- 12/2004: Astrophysics Colloquium, Fermilab (US)
- 12/2004: Seminar at the Astronomy Department, Princeton (US)
- 07/2005: Institute Seminar at Institute of Astronomy Cambridge (UK)
- 02/2006: Institute Seminar at Durham (UK)
- 10/2006: Institute Seminar at Trieste Observatory (Italy)
- 11/2006: Institute Seminar at Scuola Normale Superiore di Pisa (Italy)
- 03/2007: Institute Seminar at ICTP (Institute Cosmology and Theoretical Physics (Trieste, Italy)
- 05/2007: Seminar at IASF/BO. Institute for astrophysics (Bologna, Italy)
- 05/2008: Institute Seminar in Marseille (France)
- 07/2009: Seminar at osservatorio Astronomico di Palermo (Italia)
- 12/2010: Joint Astronomical Colloquium Heidelberg (Germany)

- 10/2011: Institute seminar at INAF/BRERA (Milan)
- 04/2014: Institute seminar at Royal Observatory of Edinburgh
- 11/2014: Institute seminar Università di Torino/Dipartimento di Fisica
- 05/2016: Gentner colloquium at MPIK (Heidelberg, Germany)
- 11/2016: Institute seminar at Aachen University (Germany)

Conferences

- 9/2000: Joint 2000 annual meeting: European TMR network The Formation and Evolution of galaxies and European RTN network The Physics of the Intergalactic Medium, Durham (UK) - Oral presentation
- 9/2000: National School of Cosmology and Astrophysics, Asiago (Italy) - Oral presentation
- 04/2001: RTN workshop Computational Investigations of the Intergalactic Medium, Garching (Germany) - Oral presentation
- 06/2001: IAP colloquium: Gaseous Matter in Galaxies and in the Intergalactic Space, Paris (France) - Poster presentation
- 06/2001: RTN workshop The First Stars and the Reionization of the Universe, Florence (Italy) - Talk
- 08/2001: Lighthouses of the Universe, Garching (Germany)
- 10/2001: National School of Astrophysics, Trieste (Italy) - Oral presentation
- 10/2001: RTN network The Physics of the Intergalactic Medium, Eibsee (Germany) - Oral presentation
- 02/2002: Lyman- α emission at high redshift, Institute of Astronomy, Cambridge (UK)
- 06/2002: Elba (Italy) 2002 conference. Early cosmic structures and the end of the dark ages - Oral presentation
- 07/2002: Cambridge, UK. Making light of gravity - Poster presentation.
- 09/2002: Gargozza (Italy) RTN annual meeting The Physics of the IGM - Oral presentation
- 11/2002: Roma (Italy). Convegno nazionale di Cosmologia - Oral presentation
- 06/2003: Blois (France). XVth rencontres de blois Physical Cosmology - Oral presentation
- 09/2003: Ile d'Óleron (France). RTN annual meeting The Physics of the IGM - Oral presentation
- 10/2003: Vulcano (Italy). International workshop on Modelling the intergalactic and intra-cluster media - Oral presentation

- 04/2004: La Thuile (Italy). XXXIXth Rencontres de Moriond on Exploring the Universe - Oral presentation
- 05/2004: Haifa (Israel). Meeting Mass and Light in the Universe - Oral presentation
- 09/2004: Leiden (Holland). RTN annual meeting The Physics of the IGM - Oral presentation
- 10/2004: Novigrad (Croatia). Conference Baryons in dark matter halos - Oral presentation
- 11/2004: Santa Barbara (US). Workshop Galaxies-Intergalactic Medium Interactions - Oral presentation
- 03/2005: Shanghai (China). IAU 1999 Colloquium Probing galaxies through quasar absorption lines - Oral presentation
- 04/2005: Granada (Spain). Cosmology Workshop - Oral presentation
- 06/2005: Trieste (Italy). Conference on Computational Cosmology - Oral presentation
- 08/2005: Chiemsee (Germany). IGM Workshop. Oral Presentation
- 10/2005: Austin (Texas, US). The Lyman- α forest as a cosmological probe at the Frank N. Bash 2005 symposium - Invited review
- 06/2006: Valencia (Spain). Bernard's cosmic stories conference - Oral presentation
- 09/2006: Conca Specchiulla (Lecce, Italy). Constraints on neutrinos from Lyman- α - Invited
- 01/2007: Virgo Meeting (Leiden, Holland) oral presentation: The high redshift Lyman- α forest and the nature of dark matter
- 04/2007: IFAE conference (Naples, Italy) Fundamental Physics with the Intergalactic Medium - Invited
- 07/2007: Conference HI survival trough cosmic time - Oral presentation
- 02/2008: Entapp (DESY, Hamburg) - Invited chair of DM session and oral presentation
- 02/2008: Conference at APC (Paris) Dark matter at small scales - Oral presentation
- 04/2008: IFAE 2008 Bologna - Oral presentation
- 06/2008: IAP colloquium 2008 (Paris) The universe above $z=3$ - Oral presentation
- 02/2009: Galilei Institute Florence (Italy). Dark Matter" - Oral presentation
- 06/2009: COSMO 09 Conference CERN (Switzerland) - Invited plenary
- 02/2010: La Thuile (Italy) Rencontres de Moriond on Cosmolgy - Oral presentation
- 06/2010: ESF workshop The almost Gaussian Universe-Non-Gaussianity with high redshift large scale structure probes - Oral presentation

- 09/2010: Workshop H-Metal presso El Escorial Madrid - Chairman/organizer of a parallel session
- 07/2010: International Conference Darkness Visible (Cambridge, UK) - Oral presentation
- 05/2011: CosmoFirstObjects conference in Marseille, France - Oral presentation
- 06/2011: PPC workshop at CERN (Geneva, Switzerland): Vth international workshop on the interconnection between particle physics and cosmology - Oral presentation
- 07/2011: Cosmology School in Santa Fe (New Mexico, US) - Oral presentation
- 04/2012: 2012 MPA-Ift Spring Workshop on LSS (La Cristalera, Madrid) - Oral presentation
- 05/2012: Euclid consortium meeting (Leiden, France) - Oral presentation
- 05/2013: Euclid consortium meeting (Marseille, France) - Oral presentation
- 05/2013: SAIT 2013 (Società Italiana di Astronomia, Bologna Italy) - Invited
- 06/2013: Intergalactic Interaction Workshop (Edinburgh, UK) - Invited
- 07/2013: Ripples in the cosmos conference (Durham, UK) - Oral presentation
- 07/2013: Tracing the cosmic-structure with galaxy clusters at Sexten (Italy) - Oral presentation
- 09/2013: SIF (Società Italiana di Fisica Trieste, Italy) - Invited
- 09/2013: Cosmological constraints on massive neutrinos at ICTP Workshop on the Origin of Neutrino Mass - From Majorana to LHC - Invited
- 12/2013: Euclid OULE3 meeting (Nice, France) - Oral presentation
- 02/2014: Munich (Germany), Interdisciplinary Cluster Workshop on Dark Matter - Invited
- 05/2014: SAIT 2014, Milano (Italy) - Invited
- 06/2014: APP14 TeVPA/IDM (Amsterdam, Netherlands) - Invited plenary speaker
- 07/2014: EWASS 2014 (Geneve, Switzerland) - Invited parallel
- 08/2014: Conference “high redshift baryons” (ICTP, Trieste) - Oral presentation
- 09/2015: COSMO-15 Conference in Warsaw (Poland) - Invited plenary speaker
- 06/2016: Neutrino 2016 conference in London (UK) - Invited plenary speaker

Publications

219 publications; 171 peer-reviewed publications
(from http://adsabs.harvard.edu/abstract_service.html)

5 Selected Publications

[1, 2, 3, 4, 5]

Full list of publications

- [1] **Viel, M.**, J. Lesgourgues, M. G. Haehnelt, S. Matarrese, and A. Riotto. Constraining warm dark matter candidates including sterile neutrinos and light gravitinos with WMAP and the Lyman- α forest. *PhRvD*, 71(6):063534, March 2005.
- [2] **Viel, M.**, J. Lesgourgues, M. G. Haehnelt, S. Matarrese, and A. Riotto. Can Sterile Neutrinos Be Ruled Out as Warm Dark Matter Candidates? *Physical Review Letters*, 97(7):071301, August 2006.
- [3] **Viel, M.**, G. D. Becker, J. S. Bolton, M. G. Haehnelt, M. Rauch, and W. L. W. Sargent. How Cold Is Cold Dark Matter? Small-Scales Constraints from the Flux Power Spectrum of the High-Redshift Lyman- α Forest. *Physical Review Letters*, 100(4):041304, February 2008.
- [4] **Viel, M.**, M. G. Haehnelt, and V. Springel. The effect of neutrinos on the matter distribution as probed by the intergalactic medium. *JCAP*, 6:15, June 2010.
- [5] **Viel, M.**, G. D. Becker, J. S. Bolton, and M. G. Haehnelt. Warm dark matter as a solution to the small scale crisis: New constraints from high redshift Lyman- α forest data. *PhRvD*, 88(4):043502, August 2013.
- [6] F. Villaescusa-Navarro, D. Alonso, and **Viel, M.** Baryonic acoustic oscillations from 21 cm intensity mapping: the Square Kilometre Array case. *MNRAS*, 466:2736–2751, April 2017.
- [7] A. Rorai, G. D. Becker, M. G. Haehnelt, R. F. Carswell, J. S. Bolton, S. Cristiani, V. D’Odorico, G. Cupani, P. Barai, F. Calura, T.-S. Kim, E. Pomante, E. Tescari, and **Viel, M.** Exploring the thermal state of the low-density intergalactic medium at $z = 3$ with an ultrahigh signal-to-noise QSO spectrum. *MNRAS*, 466:2690–2709, April 2017.
- [8] J. S. Bolton, E. Puchwein, D. Sijacki, M. G. Haehnelt, T.-S. Kim, A. Meiksin, J. A. Regan, and **Viel, M.** The Sherwood simulation suite: overview and data comparisons with the Lyman α forest at redshifts $2 \leq z \leq 5$. *MNRAS*, 464 : 897 – –914, *January*2017.
- [9] R. Adhikari, M. Agostini, N. A. Ky, T. Araki, M. Archidiacono, M. Bahr, J. Baur, J. Behrens, F. Bezrukov, P. S. Bhupal Dev, D. Borah, A. Boyarsky, A. de Gouvea, C. A. d. S. Pires, H. J. de Vega, A. G. Dias, P. Di Bari, Z. Djurcic, K. Dolde, H. Dorrer, M. Durero, O. Dragoun, M. Drewes, G. Drexlin, C. E. Düllmann, K. Eberhardt, S. Eliseev, C. Enss, N. W. Evans, A. Faessler, P. Filianin, V. Fischer, A. Fleischmann, J. A. Formaggio, J. Franse, F. M. Fraenkle, C. S. Frenk, G. Fuller, L. Gastaldo, A. Garzilli, C. Giunti, F. Glück, M. C.

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