# Ursula Laa

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**PROFESSIONAL EXPERIENCE**

**University assistant (tenure track),** Institute of Statistics — since 2020
University of Natural Resources and Life Sciences (BOKU)
Vienna, Austria

**Research fellow,** Department of Econometrics and Business Statistics & School of Physics and Astronomy — 2017–2020
Topic: Statistical visualisation methods for theoretical particle physics
(Advisors: Dianne Cook, German Valencia)
Monash University, Australia

**EDUCATION**

**PhD,** Theoretical Particle Physics — 2014–2017
Topic: Understanding LHC Searches for new Physics with Simplified Models
(Supervisors: Genevieve Belanger, Sabine Kraml)
LPSC Grenoble, France

**Master of Science,** Physics — 2011–2014
Topic: Interpretation of the CMS and ATLAS Simplified Models Results
University of Vienna and HEPHY, Austria
with distinction

**Bachelor of Science,** Physics — 2007–2011
University of Vienna, Austria
with distinction

**RESEARCH VISITS**

Physics Department and Data Science Centre, New York University, USA — Nov 2019
Statistics Department, University of Pennsylvania, USA — Nov 2019
Theory Group of LPSC Grenoble, France — Mar–Jul 2014
ERASMUS Exchange, Aarhus University, Denmark — 2010–2011

**AWARDS & SCHOLARSHIPS**

**ACEMS** Centre of Excellence, associate investigator — since 2019
**ENIGMASS** Cluster of Excellence, PhD fellowship — 2014–2017
**Deans List** Faculty of Physics, University of Vienna — 2014
(for outstanding academic performance during the Master's program)
**Zonta** Club Wien I-Postgraduate Award — 2013
**FEMtech** Scholarship for Master's thesis internship — 2013

## PUBLICATIONS

**JOURNAL PUBLICATIONS**

**Note:** authors are sorted alphabetically for particle physics publications (standard in the field), while they are sorted by contribution for publications in statistics journals (marked by highlighting my name in bold font).

**Casting Multiple Shadows: High-Dimensional Interactive Data Visualisation with Tours and Embeddings**
S. Lee, **U. Laa**, D. Cook
under review, arXiv:2012.06077

**Burning sage: Reversing the curse of dimensionality in the visualization of high-dimensional data**
**U. Laa**, D. Cook, S. Lee
in revision, arXiv:2009.10979

**Hole or grain? A Section Pursuit Index for Finding Hidden Structure in Multiple Dimensions**
**U. Laa**, D. Cook, A. Buja, G. Valencia
in revision, arXiv:2004.13327

**A slice tour for finding hollowness in high-dimensional data**
**U. Laa**, D. Cook, G. Valencia
Journal of Computational and Graphical Statistics, 29:3, 681-687,
https://doi.org/10.1080/10618600.2020.1777140

**Using tours to visually investigate properties of new projection pursuit indexes with application to problems in physics**
**U. Laa**, D. Cook
Computational Statistics 35, 1171-1205(2020), https://doi.org/10.1007/s00180-020-00954-8

**Connecting R with D3 for dynamic graphics, to explore multivariate data with tours**
M. Kipp, **U. Laa**, D. Cook
The R Journal (2019) 11:1, https://doi.org/10.32614/RJ-2019-002

**SModelS v1.2: long-lived particles, combination of signal regions, and other novelties**
F. Ambrogi, J. Dutta, J. Heisig, S. Kraml, S. Kulkarni, U. Laa, A. Lessa, et al.
to appear in CPC, https://doi.org/10.1016/j.cpc.2019.07.013

**Anatomy of a six-parameter fit to the $b \to s\ell^+\ell^-$ anomalies**
B. Capdevila, U. Laa, G. Valencia
Eur.Phys.J. C79 (2019) no.6, 462, https://doi.org/10.1140/epjc/s10052-019-6944-8

**Dynamical projections for the visualisation of PDFSense data**
D. Cook, U. Laa, G. Valencia
Eur.Phys.J. C78 (2018) no.9, 742, https://doi.org/10.1140/epjc/s10052-018-6205-2

**On the coverage of the pMSSM by simplified model results**
F. Ambrogi, S. Kraml, S. Kulkarni, U. Laa, A. Lessa, W. Waltenberger
Eur.Phys.J. C78 (2018) no.3, 215, https://doi.org/10.1140/epjc/s10052-018-5660-0

**Simplified dark matter models with a spin-2 mediator at the LHC**
S. Kraml, U. Laa, K. Mawatari, K. Yamashita
Eur.Phys.J. C77 (2017) no.5, 326, https://doi.org/10.1140/epjc/s10052-017-4871-0

**SModels v1.1 user manual: Imporving simplified model constraints with efficiency maps**
F. Ambrogi, S. Kraml, S. Kulkarni, U. Laa, A. Lessa, V. Magerl, J. Sonneveld, M. Traub, W. Waltenberger
CPC 227 (2018) 72-98, https://doi.org/10.1016/j.cpc.2018.02.007

**Collider limits on new physics within micrOMEGAs**
D. Barducci, G. Belanger, J. Bernon, F. Boudjema, J. Da Silva, S. Kraml, U. Laa, A. Pukhov
CPC 222 (2018) 327-338, https://doi.org/10.1016/j.cpc.2017.08.028

**Scalar versus fermionic top partner interpretations of $t\bar{t} + E_T^{\rm miss}$ searches at the LHC**
S. Kraml, U. Laa, L. Panizzi, H. Prager
JHEP 1611 (2016) 107, https://doi.org/10.1007/JHEP11(2016)107

**Probing U(1) extensions of the MSSM at the LHC Run I and in dark matter searches**
G. Belanger, J. Da Silva, U. Laa, A. Pukhov
JHEP 1509 (2015) 151, https://doi.org/10.1007/JHEP09(2015)151

**Constraints on sneutrino dark matter from LHC Run 1**
C. Arina, M. E. Cabrera Catalan, S. Kraml, S. Kulkarni, U. Laa
JHEP 1505 (2015) 142, https://doi.org/10.1007/JHEP05(2015)142

**SModelS: A tool for interpreting simplified-model results from the LHC and its application to supersymmetry**
S. Kraml, S. Kulkarni, U. Laa, A. Lessa, W. Magerl, D. Proschofsky-Spindler, W. Waltenberger
Eur.Phys.J. C74 (2014) 2868, https://doi.org/10.1140/epjc/s10052-014-2868-5

**SOFTWARE**

Main developer of the R packages **spinebil** (for evaluating the performance of projection pursuit index functions) and **galahr** (a GUI for the tourr package)

Maintainer of the R packages **binostics** (calculation of graph-theoretic scagnostics) and **tourrGUID3** (D3 based tourr GUI)

Contributor to the R package **tourr** (implementation of tour algorithms in R)

Developer of the Python package **SModelS** for re-interpretation of results in particle physics

**CONFERENCE PAPERS & PREPRINTS**

**High-dimensional data visualisation with the grand tour**
U. Laa
EPJ Web of Conferences 245, 06018 (2020)

**Fitting in or odd one out? Pulls vs residual responses in $b \to s\ell^+\ell^-$**
B. Capdevila, U. Laa, G. Valencia
arXiv:1908.03338

**SModelS – new developments and applications**
U. Laa
PoS ICHEP2018 (2019) 516

**Les Houches 2017: Physics at TeV Colliders New Physics Working Group**
arXiv:1803.10379

**On the coverage of the pMSSM by simplified model results**
U. Laa
PoS EPS-HEP2017 (2017) 300, arXiv:1709.10386

**Les Houches 2015: Physics at TeV colliders – new physics working group report**
arXiv:1605.02684

**Interpreting LHC searches for new physics with SModelS**
U. Laa
PoS EPS-HEP2015 (2015) 105, arXiv:1510.01999

**SModelS v1.0: a short user guide**
S. Kraml, S. Kulkarni, U. Laa, A. Lessa, V. Magerl, W. Magerl, D. Proschofsky-Spindler, M. Traub, W. Waltenberger
arXiv:1412.1745

## TEACHING

**TEACHING EXPERIENCE**

**Tutor at Monash University** from 2020
Statistical Learning
Supervision of computational labs

**Practical Exercises at University Grenoble Alpes** 2015–2017
Nuclear physics for Radioprotection Master
Nuclear physics for Physics Master
Muon measurements for Physics Bachelor

**Tutor at University of Vienna** 2011–2013
Weekly seminar for first semester physics students

**SUPERVISION**

Co-advised several PhD, Honours and undergraduate research students

Main advisor for an Honours project on machine learning and visualisation for particle physics searches and in a summer research project on clustering and visualisation

## PRESENTATIONS

**COLLOQUIA & WORKSHOPS**

**Data Visualisation New York Meetup** Nov 2019
High-dimensional data visualisation with tours

**Technical Talk** Sep 2019
ARC Centre of Excellence for Mathematical & Statistical Frontiers
An Introduction to the Visualisation Ecosystem in R (with Stuart Lee)

**Colloquium** Apr 2019
School of Physics and Astronomy, Monash University, Australia
High-dimensional data visualisation for physics applications

**Workshop** Mar 2019
Business Analytics Seminar, Monash University, Australia
An Introduction to gganimate (with Mitch O'Hara-Wild and Nick Spyrison)

**CONFERENCE TALKS & POSTERS**

**ACEMS Retreat** Nov 2020
ARC Centre of Excellence for Mathematical & Statistical Frontiers virtual retreat
Talk: Reversing the cures of dimensionality in the visualization of high-dimensional data

**Conference on Computing in High Energy and Nuclear Physics** Nov 2019
Adelaide, Australia
Talk: High-dimensional data visualisation with the grand tour

**UseR!** July 2019
Toulouse, France
Talk: Visualising high-dimensional data:
new developments of the tourr package using Shiny and plotly

**Visualisation Matters** May 2019
Canberra, Australia
Invited talk: Visualisation in Physics

**Australian Meeting on Accelerator-Based Particle Physics** Feb 2019
Melbourne, Australia
Talk: Anatomy of a six-parameter fit to the $b \to s\ell^+\ell^-$ anomalies

**International Conference on High Energy Physics** Aug 2018
Seoul, Korea
Talk: SModelS - new developments and applications

**European Physical Society Conference on High Energy Physics** July 2017
Venice, Italy
Talk: On the coverage of the pMSSM by Simplified Model results

**Rencontres de Physique des Particules** April 2017
Centre de Physique des Particules de Marseille, France
Talk: Simplified dark matter models with a spin-2 mediator at the LHC

**Open Questions in Particle Physics and Cosmology** April 2017
Convention Centre by the Observatory, Goettingen, Germany
Talk: Simplified dark matter models with a spin-2 mediator at the LHC

**(Re)interpreting the results of new physics searches at the LHC** Dec 2016
CERN, Geneva, Switzerland
Talk: Scalar versus fermonic top partner interpretations of
$t\bar{t} + E_T^{miss}$ searches at the LHC

**(Re)interpreting the results of new physics searches at the LHC** Jun 2016
CERN, Geneva, Switzerland
Talk: On the coverage of the pMSSM by Simplified Model results

**GDR Terascale** May 2016
Subatech, Nantes, France
Talk: SModelS & Simplified Model Sensitivity to Spin Structure

**Dark Matter at the Large Hadron Collider 2016** Mar-Apr 2016
Amsterdam, Netherlands
Poster: Interpreting LHC searches for new physics with SModelS

**SUSY 2015** Aug 2015
Lake Tahoe, California, USA
Talk: Constraints on sneutrino dark matter from LHC Run 1

**European Physical Society Conference on High Energy Physics** Jul 2015
Vienna, Austria
Poster: Interpreting LHC searches for new physics with SModelS

**GDR Terascale** Mar-Apr 2015
Saclay, France
Talk: Constraints on sneutrino dark matter from LHC Run 1

**GDR Terascale** Jun 2014
Palaiseau, France
Talk: SModelS – Interpreting Simplified Model Results

**ÖPG/SPS 2013 Annual Meeting** Sept 2013
Linz, Austria
Talk: Application of CMS and ATLAS Simplified Models Results
to Theories Beyond the Standard Model

**SEMINARS**

**Particle Physics Group Meeting** Nov 2020
Monash University, Australia (virtual)
Hole or grain? Exploring for hidden structure in multiple dimensions with the slice tour

**ICRAR/UWA Seminar** June 2020
University of Western Australia, Australia (virtual)
Visualisation beyond 3 dimensions

**Business Analytics Seminar** June 2020
Monash University, Australia (virtual)
Hole or grain? Exploring for hidden structure in multiple dimensions with the slice tour

**IFAE Seminar** July 2019
Barcelona, Spain
High-dimensional data visualisation for physics applications

**HEPHY Seminar** July 2019
Vienna, Austria
High-dimensional data visualisation for physics applications

**Particle Physics Pheno Seminar** June 2019
University of Milan, Italy
High-dimensional data visualisation for physics applications

**LPSC Theory Seminar** June 2019
Grenoble, France
High-dimensional data visualisation for physics applications

**Feast-of-Facts Seminar** May 2019
RSAA (ANU) Canberra, Australia
High-dimensional data visualisation for physics applications

**Seminar** Aug 2018
Ewha Womans University, Seoul, Korea
Statistical visualisation of particle physics data: Sensitivity of parton distribution functions

**Business Analytics Seminar** June 2018
Monash University, Australia
Statistical visualisation of particle physics data

**Particle Physics Seminar** March 2018
Monash University, Australia
Understanding LHC searches for new physics with simplified models

**PhD Thesis Defence** Sept 2017
LPSC Grenoble, France
Understanding LHC searches for new physics with simplified models

**Doctoral Seminar** Mar 2016
LPSC Grenoble, France
Interpreting LHC searches for new physics with SModelS

**SERVICE**

Referee for the R Journal and Physical Review D

Seminar organiser for Monash Business Analytics (2020)

Session co-host rstudio::global(2021) conference

**COMPUTING**

Python, R, git, LaTeX

Author of several open-source software packages

**LANGUAGES** German (native speaker)
English (fluent)
French (conversant)

**NATIONALITY** Austrian