

Curriculum Vitæ of Alexandre B. Sousa

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EDUCATION AND EMPLOYMENT

University of Cincinnati	Assistant Professor of Physics	2012-present
Harvard University	Research Associate	2008-2012
University of Oxford	Post-Doctoral Research Assistant	2005-2008
Tufts University	Ph.D. in Physics	2000-2006
Tufts University	M.Sc. in Physics	1998-2000
Universidade Técnica de Lisboa	B.Sc. in Physics	1993-1998

RESEARCH AND PROFESSIONAL EXPERIENCE

University of Cincinnati (2012–present)

- **PI of DOE Comparative Review Grant: "Long-Baseline Neutrino Oscillation Physics"** (June 2014–May 2016). Three-year renewable funding to perform sterile neutrino searches with the $\text{NO}\nu\text{A}$ experiment.
- **Fermilab's Intensity Frontier Fellow** (September 2013–June 2014). Spent extended period at Fermi National Accelerator Laboratory to develop sterile neutrino analyses of data from long-baseline experiments.
- **Chair of the $\text{NO}\nu\text{A}$ Data Authorship and Publication Committee** (July 2013–present). Responsible for appointing internal review committees for prospective publications, and for ensuring consistent high-quality for presentation of $\text{NO}\nu\text{A}$ results.
- **PI of the Ohio Supercomputer Center (OSC) Discovery-level grant "A Massively Parallel Computing Approach to the Generation of $\text{NO}\nu\text{A}$ Simulations"** (June 2013–present). Liaised with OSC contacts and Open Science Grid (OSG) leadership to configure OSC for $\text{NO}\nu\text{A}$ job submissions via OSG, simultaneously enabling OSC to provide resources to the nationwide OSG community. Administrator of the 600 000 CPU-hours allocated by OSC to generation of $\text{NO}\nu\text{A}$ simulations.
- **Invited Referee** for Physics Letters B (March 2013–present).
- **$\text{NO}\nu\text{A}$ Executive Committee Member** (April 2013–present), elected by the $\text{NO}\nu\text{A}$ Collaboration.
- **MINOS+ Physics Analysis Coordinator** (January 2013–June 2014). Overseeing and directing the MINOS+ analyses and coordinating the dissemination of analysis results. Presented analysis results at the Neutrino 2014 conference, in Boston, MA.
- **MINOS+ Executive Committee Member** (January 2013–present), elected by the MINOS+ Institutional Board.
- **Co-convenor** of the Neutrino Oscillation Physics Working Group for the International Workshop on Neutrino Factories, Super Beams and Beta Beams (NuFact) (October 2012–present).
- **Co-convenor of the $\text{NO}\nu\text{A}$ Detector Simulations Group** (April 2012–present). In charge of developing the simulated Monte Carlo data to be used in the $\text{NO}\nu\text{A}$ analyses and validating the physics modeling in the generated files.

- **Leader of the NO ν A Test Beam Planning Group** (January 2012–present). Exploring the possibility of exposing a scaled-down version of the NO ν A detectors to particle beams with known momenta in order to calibrate the NO ν A detectors and improve the Monte Carlo simulation.
- **Co-convenor of the MINOS/MINOS+ Disappearance Group** (September 2010–December 2013). Coordinated the analysis of dedicated antineutrino running data. Delivered the first public presentation of the 2011 antineutrino analysis results at a Fermilab Wine and Cheese seminar (August 2011) and co-authored the 2012 Phys. Rev. Letters publication. Led the preparation of results and publication a search for sterile neutrinos in the complete MINOS data set, presently in preparation.

Harvard University (2008–2012)

- **MINOS Deputy Physics Analysis Coordinator** (August 2011–December 2012). Co-leader of the overall MINOS analysis efforts that culminated in the presentation of new results at the Neutrino 2012 conference and their publication on refereed journals during 2013.
- **Co-convenor of the MINOS Neutral Current Analysis group** (June 2008 – September 2010). Oversaw and organized the production of the final results of the Neutral Current group. Author and editor of the Phys. Rev. Letters publication. Led the effort of expanding the results derived from the first analysis and co-authored and served as primary editor of the Phys. Rev. D publication describing in detail sterile neutrino searches in MINOS.
- **Member of the NO ν A ART Committee** (October 2010–March 2011). Co-responsible for migration of the NO ν A software infrastructure to the new "ART" framework, to be adopted by all future Intensity Frontier experiments at Fermilab (e.g. MicroBooNE, Mu2e, LBNE).
- **Member of the NO ν A Calibration Committee** (December 2008–October 2010). Responsible for determining the calibration requirements for the NO ν A ν_e analysis.
- **Internal Referee** of the MINOS Phys. Rev. D paper describing the search for oscillations of the 7% muon antineutrino component in the NuMI neutrino data sample (May 2011– October 2011). Published in Phys. Rev. D **84**, 071103 (2011).

University of Oxford (2005–2008)

- **Leader of a neutral current event PID task force** that selected the primary method for classification of neutral current events used in the MINOS sterile neutrino analysis (Summer 2007). Presented first results of the analysis at a Fermilab Wine and Cheese Seminar and co-authored the subsequent Phys. Rev. Letters publication.
- **Coordinator of the MINOS Batch Processing Group** (September 2007 – July 2009). Responsible for ensuring that MINOS Data and Monte Carlo (MC) are consistently processed through standardized reconstruction using Fermilab's General Purpose Computing Farm and are made available in a timely manner to the Collaboration. Oversaw the complete reprocessing of all Data and MC and coordinated numerous minor processings requested by the various analysis groups. Held administrative roles for the MINOS software and MySQL database installations at the farm.
- **Leader of the Validation effort for Data and MC reconstruction in MINOS** (September 2007 – July 2009). Responsible for validation of the updated MINOS event reconstruction used in reprocessing data and Monte Carlo for all MINOS analysis results presented in 2010.
- **MINOS UK representative on the GridPP User Board** (August 2007 – December 2008). Responsible for ensuring that Rutherford Appleton Laboratory's Tier 1 resources were available and adequate for MINOS Computing needs. Tier 1 resources were used to generate over 60% of the entire MINOS MC sample.

- **Performed an independent evaluation of the systematic errors** and results for the fitting methods considered in the MINOS Charged Current analysis. This was an important contribution to the first MINOS publication using NuMI beam data, a TopCite 500 paper published in Physical Review Letters (Summer 2006, in collaboration with three Oxford D. Phil. students, P. Litchfield, T. Rauber, J. Evans).

Tufts University (1998–2006)

- **Co-developer of the MINOS $\nu_\mu \rightarrow \nu_e$ analysis framework** since its inception. Author of a seedless nearest-neighbor clustering algorithm for showering event reconstruction based on matching of 3D hits (September 2003 – December 2005). The discriminator variables obtained were used in the MINOS $\nu_\mu \rightarrow \nu_e$ analysis. Developed a Multivariate Discriminant method for signal/background separation using the new variables as input, obtaining very competitive results with the leading separation method based on Artificial Neural Networks.
- **Coordinator of deployment and installation of Bdot coils** for monitoring of the MINOS Far Detector magnetic field (September 2002 – April 2003). Developed Labview-based tools for Bdot electronics readout and devised and implemented an automated magnet degaussing cycle.

AWARDS, GRANTS AND FELLOWSHIPS

- **Recipient of Ralph E. Powe Junior Faculty Enhancement Award:** "Study of Space Charge Effects with LBNE's 35 ton Detector", 2014-2015.
- **Principal Investigator in DOE Comparative Review Grant:** "Long-Baseline Neutrino Oscillation Physics", 2014-2016.
- **Recipient of a Fermilab Intensity Frontier Fellowship** by Fermi National Accelerator Laboratory, 2013-2014.
- **Principal Investigator in Ohio Supercomputing Center (OSC) Grant:** "A massively parallel computing approach to the generation of NOvA simulations", 600 000 CPU-hours of computing resources, 2013-2014.
- **Recipient of Merit Award for Excellent Performance** by the Department of Physics of the University of Oxford (2007).
- **Awarded a Royal Society Travel Grant**, International Travel Grants Scheme, The Royal Society (2007)
- **Recipient of an Outstanding Academic Performance Award** by the Department of Physics at Tufts University (2005).
- **Recipient of the John F. Burlingame Fellowship** by the Department of Physics at Tufts University (2005).
- **Recipient of a PRAXIS XXI Doctoral Fellowship** by the Fundação para a Ciência e a Tecnologia, Portugal (January 1999 – December 2002).

SELECTED PUBLICATIONS

- **Combined Analysis of ν_μ Disappearance and $\nu_\mu \rightarrow \nu_e$ Appearance in MINOS Using Accelerator and Atmospheric Neutrinos**, with P. Adamson *et al.* (MINOS Collaboration), Phys. Rev. Lett. **112**, 191801 (2014).
- **Search for Flavor-Changing Non-Standard Neutrino Interactions by MINOS**, with P. Adamson *et al.* (MINOS Collaboration), Phys. Rev. D, **87**, 072011 (2013).
- **Measurement of Neutrino and Antineutrino Oscillations Using Beam and Atmospheric Data in MINOS**, with P. Adamson *et al.* (MINOS Collaboration), Phys. Rev. Letters, **110**, 251801 (2013).
- **Electron Neutrino and Antineutrino Appearance in the Full MINOS Data Sample**, with P. Adamson *et al.* (MINOS Collaboration), Phys. Rev. Letters, **110**, 171801 (2013).
- **Improved Measurement of Muon Antineutrino Disappearance in MINOS**, with P. Adamson *et al.* (MINOS Collaboration), Phys. Rev. Letters, **108**, 191801 (2012).
- **Light Sterile Neutrinos: A White Paper**, with K. N. Abazajian *et al.*, [arXiv:1204.5379](https://arxiv.org/abs/1204.5379) (2012).
- **MINOS Search for Sterile Neutrinos**, A. Sousa, Proceedings of the XIIIth NuFact International Workshop (2011), Geneva, Switzerland, [arXiv:1110.3455](https://arxiv.org/abs/1110.3455).
- **Improved search for muon-neutrino to electron-neutrino oscillations in MINOS**, with P. Adamson *et al.* (MINOS Collaboration), Phys. Rev. Lett. **107**, 181802 (2011).
- **Search for the disappearance of muon antineutrinos in the NuMI neutrino beam**, with P. Adamson *et al.* (MINOS Collaboration), Phys. Rev. D **84**, 071103(R) (2011).
- **Active to sterile neutrino mixing limits from neutral-current interactions in MINOS**, with P. Adamson *et al.* (MINOS Collaboration), Phys. Rev. Lett. **107**, 011802 (2011).
- **Status of $\text{NO}\nu\text{A}$** , A. Sousa, Proceedings of the 14th International Workshop on Neutrino Telescopes (NeuTel 2011), Venice, Italy.
- **Long-Baseline Neutrino Oscillation Experiments**, A. Sousa, Proceedings of the 30th Physics in Collision Symposium (PIC 2010), Karlsruhe, Germany, [arXiv:1102.1125](https://arxiv.org/abs/1102.1125).
- **Observation of muon neutrino disappearance with the MINOS detectors and the NuMI neutrino beam**, (MINOS Collaboration), Phys. Rev. Lett. **97**, 191801 (2006).
- **Proposal to build a 30 KiloTon off-axis detector to study $\nu_\mu \rightarrow \nu_e$ oscillations in the NuMI beamline**, ($\text{NO}\nu\text{A}$ Collaboration), [arXiv: hep-ex/0503053](https://arxiv.org/abs/hep-ex/0503053) (2004).

SELECTED TALKS

- **Neutrino Oscillations Working Group - Plans and Questions**, Invited Talk, NUFAC 2014, Glasgow, UK, August 2014.
- **First MINOS+ Data and New Results from MINOS**, Invited Talk, Neutrino 2014, Boston, MA, June 2014.
- **Long-Baseline Neutrino Experiments in the US**, Invited Seminar, University of California - Irvine, Irvine, CA, May 2014.
- **Future Neutrino Experiments**, Invited Seminar, Intensity Frontier Seminar Series, Fermilab, Batavia, IL, March 2014.
- **Planning for Future Neutrino Experiments**, Invited Talk, Frontiers of Particle Physics: From Dark Matter to the LHC and Beyond, Aspen, CO, January 2014.

- **RADAR - R&D Argon Detector at Ash River**, Invited Talk, Presentation to the LBNE Collaboration, Fort Collins, CO, September 2013.
- **Update on the Global Liquid Argon Detector Experiment (GLADE)**, Invited Talk, Pre-Snowmass Intensity Frontier Meeting - Neutrino Subgroup, SLAC, CA, March 2013.
- **PMNSFitter, an Experiment-Driven Neutrino Oscillation Global Fit**, Invited Talk, 8th Rencontres du Vietnam, Towards CP Violation in Neutrino Oscillations (VietNus 2012) Workshop, Qui Nhon, Vietnam, December 2012.
- **Measuring Neutrinos and Antineutrinos with MINOS and MINOS+**, Invited Talk, Project X Physics Study Workshop, Fermi National Accelerator Laboratory, Batavia, IL, USA, June 2012.
- **Search for Sterile Neutrino Mixing in MINOS**, Contributed Poster, Neutrino 2012, Kyoto, Japan, June 2012.
- **Unraveling the Neutrino Mysteries with Long-Baseline Experiments**, Physics Colloquium, University of Cincinnati, Cincinnati, OH, USA, March 2012.
- **Long-Baseline Neutrino Experiments: Present and Future**, IFIC Colloquium, IFIC, València, Spain, December 2011.
- **Latest Results from MINOS and Future Prospects**, Particle Seminar, Columbia University, New York City, NY, USA, November 2011.
- **Sterile Neutrino Searches with MINOS**, Invited talk, International Workshop on Sterile Neutrinos at the Crossroads (SNAC11), Virginia Tech, Blacksburg, VA, USA, September 2011.
- **New Antineutrino Oscillation Results from MINOS**, Joint Experimental-Theoretical (Wine and Cheese) Seminar, Fermi National Accelerator Laboratory, Batavia, IL, USA, August 2011.
- **MINOS Search for Sterile Neutrinos**, Invited talk, XIIIth International Workshop on Neutrino Factories, Superbeams and Beta beams (NuFact 11), University of Geneva and CERN, Geneva, Switzerland, August 2011.
- **Status of $\text{NO}\nu\text{A}$** , Plenary talk, 14th International Workshop on Neutrino Telescopes (NeuTel 2011), Palazzo Franchetti, Venice, Italy, March 2011.
- **Long-Baseline Neutrino Oscillation Experiments**, Invited review talk, XXX International Symposium on Physics in Collision (PIC 2010), Karlsruhe Institute of Technology, Karlsruhe, Germany, September 2010.
- **First Results from Analysis of Neutral Current Interactions in MINOS**, Joint Experimental-Theoretical (Wine and Cheese) Seminar, Fermi National Accelerator Laboratory, Batavia, IL, USA, April 2008.

TEACHING EXPERIENCE

- **General Physics I (Fall Semester 2014) - Professor**, University of Cincinnati.
- **General Physics II (Spring Semester 2013) - Professor**, University of Cincinnati.
- **2nd Year Further Quantum Physics (Hilary 2008, Trinity 2008) - Tutor**, St. Anne's College, University of Oxford.
- **Nuclear Physics Particle Course (January 2007–June 2008) - Senior Demonstrator**, University of Oxford.
- **Nuclear Physics Particle Course (September 2006–December 2006) - Junior Demonstrator**, University of Oxford.
- **Physics 1/11 (Fall Semester 1998) - Laboratory Supervisor, Grader**, Tufts University.

SUPERVISION AND GUIDANCE OF STUDENTS

UC Graduate students:

- Jacob Todd - September 2014 – present.
- Shaokai Yang - May 2013 – present.
- Josh Eby - Summer 2012.

UC Undergraduate students:

- Micah Groh - April 2013 – present.

UNIVERSITY OF CINCINNATI SERVICE

- **Diversity Committee** (July 2013–present).
- **Department of Physics Graduate Admissions Committee** (September 2012–present).
- **Qualifying Exam Committee** (June 2013–August 2013).
- **HEP/Astrophysics Seminar series Coordinator** (Spring 2013).
- **Oral Candidacy Exam Committee** (September 2012–December 2012).

UNIVERSITY OF CINCINNATI OUTREACH

- **Co-organized UC Physics GRE Bootcamp including several students from outside UC** (August 2014).
- **Lecture on neutrino physics to class of high-school teachers during UC's QuarkNet 2014 program** (June 2014).
- **Presentation on "Finding Neutrinos" during Regional High-School Student UC Visit** (June 2013).