Yuriy Volkotrub

Curriculum vitæ

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Experience

Research Experience

Jun. 2021 – Aug. 2021 **BAND Summer Fellowship**, *BAND Collaboration*, USA.
Bayesian analysis in various applications of theoretical nuclear physics. To investigate two major problems: the presence of unknown or observable parameters that must be inferred using data, and the reality that all models are at least to some extent in error. The focus of my fellow project:
- train a Faddeev emulator with an off-the-shell method
- use a set of three-nucleon (3N) parameters (informed by prior calculations) and obtain an array of nucleon-deuteron scattering observable
- use the emulator to perform uncertainty quantification on the 3N force (fixing the two-nucleon force)

Oct. 2016 – Present **Junior Research Associate**, *Dpt. of Theory of Nuclear Systems, Jagiellonian University*, Cracow, Poland.
Investigations of elastic nucleon-deuteron scattering and nucleon-induced deuteron breakup processes
- Developed programs/scripts, performed calculations on the elastic and inelastic nucleon-deuteron scattering using different models of the nuclear forces
- Investigated the impact of various theoretical uncertainties in the three-nucleon scattering systems
- Performed analysis on theoretical data sets using Mathematica®, which was carried out to study the correlations among various two- and three-nucleon observables, as well as between the observables and specific potential parameters of the model of a nucleon-nucleon interaction.

2013 – 2016 **Student projects**, *Dpt. of Theoretical and Experimental Nuclear Physics, Odesa National Polytechnic University (ONPU)*, Odesa, Ukraine.
- Worked in a team of 6 people, performed some part of calculations of the cross section for the proton-proton inelastic scattering by applying the Laplace method.
- Developed a Monte-Carlo generator based on the Laplace method for the inelastic hadron scattering process using the simplest model ϕ^3.
- Tested the model of the solar luminosity which is based on the model of axion mechanism of solar radiation in combination with the solar dynamo model of Parker.

Teaching Experience

2017 – 2019 **Teaching Assistant**, *Jagiellonian University*, Cracow, Poland.
- Tutored weekly laboratory classes for "Advanced Materials and Nanotechnologies" students each summer semester.
- Prepared statistical web applets for students' practice (in Javascript).
- Led Physics laboratory classes for schoolchildren.
- Conducted "Probability and Statistics" course for students of the second year of computer science.

Oct. 2014 – Jul. 2015 **Private tutor**, Odesa, Ukraine.
- Private tutoring the students at the primary school level, a secondary school in Maths, Chemistry, and Physics. Also preparing students to apply for universities.

Education

Oct. 2016 – Sept. 2021 **Doctor of Philosophy in Physics**, Jagiellonian University, Kraków.
Thesis: "Covariance matrix of nucleon-nucleon potential parameters in few-nucleon studies"
Supervisor: dr hab. Roman Skibiński

Sept. 2015 – Jun. 2016 **Erasmus Mundus exchange programme for master students**, *Jagiellonian University*, Kraków, Poland.
Full time graduate study in the field of physics and astronomy

Sept. 2014 – Jun. 2016 **Master of Science in Physics of nucleus and high energies**, ONPU, Odesa.
with honours
Thesis: "Thermomagnetic Ettingshausen-Nernst effect in tachocline and axion mechanism of Sun luminosity"
Supervisor: prof. dr V.D. Rusov

Sept. 2010 – Jun. 2014 **Bachelor of Science in Physics**, ONPU, Odesa.
with honours
Thesis: "Laplace's method for scattering processes of Monte-Carlo event generators"
Supervisor: dr I.V. Sharph

Selected courses

- Advanced Quantum Mechanics (Path Integrals)
- Introduction to Data Science
- Time Series Analysis
- Few-body nuclear physics
- Quantum Mechanics in Nuclear Physics
- Relativistic Heavy-Ion collisions

Skills

Programming	confident in *Mathematica*, Fortran 90 and Python (NumPy, SciPy, Seaborn, Pandas, Matplotlib, Scikit-learn etc.), JavaScript (basics), C/C++ and *R* (rudimentary)
Tools/Software	Mathematica®, Jupyter Notebook, Bash, Gnuplot, LaTeX, Vim
Computer/Technical	Git and version control, Linux (Debian, Mint), ssh etc.
Laboratory equipment	Multimeters, oscilloscopes, spectrum analyzers
General	Data visualization and manipulation
Other	Strong mathematics and statistics background

Languages

English (Upper Intermediate), Polish (Upper Intermediate), Russian (Fluent), Ukraine (Native)

Professional Interests

Research Nuclear physics, Nuclear Theory, Quantum Few-Body Physics, Scattering Theory, Statistical and Machine Learning, Calculus

Other Data Science, Bayesian Statics and Machine Learning, AI

Interests

- Mountaineering
- Solving mathematical problems and coding
- History
- Music

Online-Courses

- Python, Kaggle
- Python Programmer Track, Data Scientist with Python, DataCamp

Selected talks and publications

- "The 8th Asia-Pacific conference (online) on Few-Body problems in Physics (APFB2020)", March 1-2, 2021, Kanazawa, Japan
  Title: "Covariance matrix of nucleon-nucleon potential parameters in few-nucleon systems"
- "Bayesian Inference in Subatomic Physics - A Marcus Wallenberg Symposium", Chalmers University, Gothenburg, Sweden, September 17-20, 2019
  Title: "Uncertainty quantification and correlation among three-nucleon scattering observables"

- "The 24th European Conference on Few-Body Problems in Physics", University of Surrey, Guildford, UK, September 2-6, 2019
  Title: "Correlation analysis and statistical uncertainty of three-nucleon scattering observables"
- Zakopane Conference on Nuclear Physics "Extremes of the Nuclear Landscape", Zakopane, Poland, August 26 - September 2, 2018
  Title: "Theoretical uncertainties in the description of the nucleon-deuteron elastic scattering up to 200 MeV"
- P. Maris *et al.*, "Light nuclei with semilocal momentum-space regularized chiral interactions up to third order", Phys. Rev. C 103, 054001 (2021) [Editors' suggestion]
- Yu. Volkotrub, J.Golak, R. Skibiński, K. Topolnicki, H. Witała, E. Epelbaum, H. Krebs, P. Reinert, "Uncertainty of three-nucleon continuum observables arising from uncertainties of two-nucleon potential parameters", J. Phys. G: Nucl. Part. Phys. 47 10 (2020)
- E. Epelbaum, J.Golak, K. Hebeler, H. Kamada, H. Krebs, U.-G. Meißner, A. Nogga, P. Reinert, R. Skibiński, K. Topolnicki, Yu. Volkotrub, and H. Witała, "Towards high-order calculations of three-nucleon scattering in chiral effective field theory", Eur. Phys. J. A (2020) 56:92
- R. Skibiński, Yu. Volkotrub, J. Golak, K. Topolnicki and H. Witała, "Theoretical uncertainties of the elastic nucleon-deuteron scattering observables", Phys. Rev. C **98**, 014001 (2018).
- R. Skibiński, J. Golak, K. Topolnicki, H. Witała, and Yu. Volkotrub *et al.*, "Nucleon-deuteron scattering with the JISP16 potential", Phys. Rev. C 97, 014002 (2018)