Javad Ebadi

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Education

2015–2020 **PhD in Particle Physics**
Institute for Research in Fundamental Sciences (IPM), Tehran, Iran
GPA 18.26/20
Thesis Top quark as a tool to probe new physics
Adviser Mojtaba Mohammadi Najafabadi

2013–2015 **MSc in Physics (Gravity)**
Sharif University of Technology, Tehran, Iran
GPA 18.9/20
Thesis Horizons of a radiating cosmological black hole
Advisers Reza Mansouri, Javad Taghizadeh Firouzjaee

2010–2013 **BSc in Physics**
Amirkabir University of Technology (Tehran Polytechnic), Tehran, Iran
GPA 16.51/20
Project Quantum mechanics in curved spacetime

2008–2010 **BSc in Mechanical Engineering**
Amirkabir University of Technology (Tehran Polytechnic), Tehran, Iran

Research Interest

- **Data Science and Machine Learning**
- **Particle Physics Phenomenology:** Beyond the Standard Model (BSM) searches at colliders, Axion-like particles, Dark Matter, Higgs physics, Top quark physics
- **Experimental Particle Physics**

- **Machine Learning in Physics:** Top tagging, Quark/gluon jet discrimination
- **Cosmology**

Research Experience

2020 We are developing a python app to study particle physics community. Network science has given valuable insights about social media users and their connections. We are trying to develop tools and define concepts to study particle physics community and their connection. Our main source of information are Inspirehep and arXiv. We have developed codes and collected information about all institutions in particle physics around the world. Currently, we had faced challenges in authors citations database which needs a new technology. In this project, we use web-scraping, SQL and No-SQL databases, machine learning and web-scraping and the final result will be a report which could lead to several interesting papers in data analysis and machine learning.

2020 Data science ethics and privacy are getting more important as companies use data science more. In future, data ethics will be a competitive advantage for businesses. I wrote a proposal in data science ethics for Research Institute of National Center of Cyberspace. The project accepted and I got funds to research on data ethics. I am currently writing a book in Persian (180 page; page: 350 words) on data ethics including topics such as informed consent, concepts of data science and Machin learning, data ownership, ethics of web-scraping, privacy, data validity, social impacts of data science, algorithmic justice. In addition, I will interview head of data scientists at Cafe Bazzar, Digikala, Tap30 and Dataak and write a report which will be used in final chapter of the book.

2020 I was involved in a philosophy of science project. There are criteria to determine what is real in science. For example, robustness is on criteria which states that if one can engage with a physical object from various different ways, then we can say that is real. However, there are examples such as the Higgs boson that is produced only at colliders and therefore is not robust. However, Higgs is real. In this project, we try to give a new criteria for reality such that the Higgs could be considered as real. Our idea, was reality as resistance. Higgs is real since it is reproducible and resisted to be excluded.

2019 I was involved in CMS experiment at CERN for 5 months at IPM. The analysis was "single top plus photon" channel. The project was made up of a several parts. The first part was writing an analysis code in which I used the 2016 data to write and debug my code. I wrote my codes in C++, Python and Bash. The link for my code is available here. Since the CMS experiment constantly updates its criteria for analysis, I have written a code such that it can be easily updated and adapted to the new situation. The other part of the project was about reading data from CMS database which was being done using CMS experiment tools.

2018-2019 Axions and axion-like particles are well motivated particles in many beyond the Standard Model scenarios. We suggested new channels to study these models at the HL-LHC. Our results showed that LHC searches for axions is complementary to low energy experiments. The simulation and analysis process was similar to my previous works.

2017-2018 My first job in numeric calculation and collider phenomenology was about same sign tops in FCNC models. We used MadGraph and generated sample of events for various couplings at the LHC. We used Pythia to shower and hadronize. Then, passed the events to Delphes for detector simulation in CMS detector. The analysis of events was done using root-cern data analysis framework. We performed statistical inference to set bounds on parameters of the new physics model.

2016-2017 For part of my qualification exam in PhD, I reviewed Dark Matter (DM) physics. I reviewed theoretical topics such as DM production in the early Universe, thermal freeze-out, freeze-in and calculated analytical formulas related to them. The DM detection methods including collider searches, direct and indirect detection. The PDF file of the review could be found in here.

2015 In my MSc thesis, I was working on theoretical physics. The problem was about the horizons of a black hole which was radiating. I have used xAct to do some tensor calculation. The xAct is a very powerful Mathematica package with a tremendous ability to do analytical tensor calculation. I was computing the rate of Hawking radiation for various vacuum of black holes.

Teaching Experience

2020 **An Introduction to Programming with Python**

- Basics: data types, function, class, object oriented programming, error handling
- Database: introduction to SQL database in Python using sqlalchemy
- GUI: graphical user interface apps using tkinter
- Data Science and AI: data science, basics of machine learning, numpy, pandas and scikit-learn, tensorflow
- Web-scraping: regular expressions, text processing, web-scraping with Selenium
- NLP: Natural Language Processing with Python and nltk, sentiment analysis

2019-2020 **Data Science with Python**.

2019 **High School Physics**.

2018 **MadGraph software for Monte Carlo simulation**. The link for videos of this lecture are here in Persian.

2018 **root-cern data analysis framework**. The link for videos of this lecture are here in Persian.

Social Media Experience

2017-now **Administrator of a social media channel for particle physics**. In September 2017, I created a Telegram (Social Media app) channel to post important arXiv papers, news and other related topics to particle physics such as machine learning. A few months later, my friend, Majid Ekhterachian from the University of Maryland, joined the channel as an administrator. Our channel has over 500 subscribers which are mainly graduate students and faculties in physics. The contents are in Persian and English languages and our mission is to spread news about particle physics in our country. The link for this media is here. Since 2020, Reza Ebadi from University of Maryland and Mohammad Hassan Hassanshahi from Imperial College London are joined to channel as administrators.

Publications

- **Data Science and Machine Learning Ethics**
  A book (Persian) which is in preparation for National Center of Cyberspace
  Project for National Center of Cyberspace
- **An Introduction to Quantum Brain**
  A book (Persian) which is in preparation to be published by Supreme National Defense University Publication
  Derived from my military project in lieu of compulsory military service

- **A review on quantum brain and quantum consciousness**
  In preparation to be submitted in Science Cultivation
  Derived from my military project in lieu of compulsory military service
- **Reality as Resistance: How Entity Realism Meets Perspectivism**
  Under review in Philosophy of Science
  I collaborated in a philosophy of science project; I presented the Higgs case study to support the idea of reality as resistance. Higgs is real since it is reproducible and resisted to be excluded.
- **Signs of new physics in top quark pair production associated with a neutrino pair at the LHC**
  Daruosh Haji Raissi, Javad Ebadi, Mojtaba Mohammadi Najafabadi
  Apr 16, 2020. 13 pp.
  DOI: 10.1103/PhysRevD.101.095002
- **Standard Model Physics at the HL-LHC and HE-LHC HL-LHC Collaboration and HE-LHC Working Group**
  (P. Azzi et al.).
  Feb 11, 2019. 219 pp.
  DOI: 10.23731/CYRM-2019-007.1
- **New probes for axionlike particles at hadron colliders**
  Javad Ebadi, Sara Khatibi, Mojtaba Mohammadi Najafabadi.
  Jan 10, 2019. 11 pp.
  DOI: 10.1103/PhysRevD.100.015016
- **Performance of fully-connected neural networks for top tagging**
  Javad Ebadi, Daruosh Haji Raissi
  26th IPM Physics Spring Conference
- **Same-sign top pair plus W production in flavor changing vector and scalar models**
  Javad Ebadi, Fatemeh Elahi, Morteza Khatiri, Mojtaba Mohammadi Najafabadi.
  Jun 9, 2018. 15 pp.
  DOI: 10.1103/PhysRevD.98.075012

Computer skills

- **Programming Languages:** C/C++, Python, Java, Bash scripting
- **Markup Languages:** LATEX, HTML, Markdown
- **Version Control Systems (VCS):** Git, Github
- **Text Editors and Notebooks:** Vim, Jupyter-Notebook, Atom
- **Operating Systems (OS):** Unix/Linux, Windows, Android
- **Computational Softwares:** Wolfram Mathematica, MATLAB/Octave
- **Particle Physics Packages (Theory):** FeynRules, FeynCalc
- **Particle Physics Packages (Numeric):** MadGraph (event generation), Delphes (detector simulation), root-cern (data analysis)

Data Science and Machine Learning Skills

Portfolio Since August 15, 2019, I create a portfolio for data science and machine learning here.

- **Story Telling and Writing Reports**

- **Getting Data**
- **SQL:** Create, query and update databases in SQLite, PostgreSQL, sqlalchemy
- **Data Cleaning and Pre-processing**
- **Data Visualization:** Tableau, matplotlib (Python), seaborn (Python), Mathematica, root (C++)
- **Data Analysis:** numpy (Python), pandas (Python), root (C++)
- **Statistics:** Probability, inference, estimation, confidence level, hypothesis test
- **Machine Learning:** scikit-learn, keras, tensorflow
- **Machine Learning Algorithms:** linear regression, logistic regression, boosted decision trees (BDT), support vector machines (SVM), k-nearest neighbors (kNN), k-means, principal component analysis (PCA), neural networks (NN), deep neural networks (DNN), convolutional neural networks (CNN), anomaly detection, recommender systems
- **Machine Learning Concepts:** linear algebra, calculus, supervised learning, unsupervised learning, reinforcement learning, forward propagation, backward propagation, loss function, cost function, optimizers, adam optimizer, gradient descent, stochastic gradient descent, hyper-parameter optimization, SVM kernel, convolution, transfer learning, metrics, precission, recall, confusion matrix, F1 score, ROC, AUC

Selected Physics Coursework

- Mathematical Physics I (18.9/20)
- Classical Mechanics (17.5/20)
- Advanced Quantum Mechanics (19.5/20)
- General Relativity (18.0/20)
- Quantum Field Theory I (18.0/20)
- Mathematical Physics II (20.0/20)
- Advanced Electrodynamics (18.0/20)
- Advanced Statistical Mechanics (20.0/20)
- Particle Physics (16.5/20)
- Quantum Field Theory II (18.5/20)

Certificates

2017 **The Unix Workbench** by Johns Hopkins University on Coursera. Certificate earned at Wednesday, September 11, 2019 (91.8%) (Link)

2018 **Machine Learning** by Stanford University on Coursera. Certificate earned at Thursday, September 26, 2019 (98.4%) (Link)

2019 **Neural Networks and Deep Learning** by deeplearning.ai on Coursera. Certificate earned at Monday, October 21, 2019 (100%) (Link)

2019 **What is Data Science?** by IBM on Coursera. Certificate earned at Friday, November 22, 2019 3:21 PM GMT (99%) (Link)

2019 **Open Source tools for Data Science** by Polong Lin, IBM on Coursera. Certificate earned at Saturday, December 7, 2019 (100%) (Link)

2019 **Python for Data Science and AI** by Joseph Santarcangelo, IBM on Coursera. Certificate earned at Sunday, November 24, 2019 (100%) (Link)

2019 **Data Analysis with Python** by Joseph Santarcangelo, IBM on Coursera. Certificate earned at Sunday, December 29, 2019 (100%) (Link)

2019 **Data Science Methodology** by Alex Aklson and Polong Lin, IBM on Coursera. Certificate earned at Monday, December 30, 2019 (100%) (Link)

2019 **Databases and SQL for Data Science** by Rav Ahuja, IBM on Coursera. Certificate earned at Tuesday, February 4, 2020 (100%) (Link)

2020 **Machine Learning with Python** by Saeed Aghabozorgi and Joseph Santarcangelo, IBM on Coursera. Certificate earned at Monday, May 3, 2020 (90.75%) (Link)

Selected Seminars and Talks

- **Data Science: The Fourth Paradigm of Science** (Supreme National Defense University - 2020)
- **New Probes for Axion-like Particles at Hadron Colliders** (IPM - 2019)
- **New Probes for Axion-like Particles at Hadron Colliders** (3rd International Turkey-Iran Joint Conference on LHC Physics - 2019)
- **Same-sign top pair plus W production in flavor changing vector and scalar models** (Two days workshop on particle physics - Shahid Beheshti University - 2018)
- **Same-sign top pair plus W production in flavor changing vector and scalar models** (IPM - 2018)
- **Dark Matter Detection Methods** (IPM - 2017)
- **Topological Defects in Cosmology** (IPM - 2017)
- **Quantum Aspects of Black Holes** (Sharif University of Technology - 2015)
- **What is Life?** (Philosophy of Science Department., Sharif University of Technology - 2014)

Selected Schools, Workshops and Conferences (Attended)

- IPM Workshop on Particle Physics Phenomenology (IWPPP) (IPM - 2019)
- IPM Workshop on Particle Physics Phenomenology (IWPPP) (IPM - 2018)
- Second Iran & Turkey Joint Conference on LHC Physics (IPM - 2017) Summer School on Particle Physics (ICTP - 2017)
- IPM Workshop on Particle Physics Phenomenology (IWPPP) (IPM - 2017)
- Summer School on Cosmology (ICTP - 2016)
- Recent Trends in String Theory and Related Topics (IPM - 2016)
- IPM school and conference on Particle Physics (IPP15): Neutrino physics, dark matter and B-physics (IPM - 2015)

English Test Scores

TOEFL(2016) 100/120

skill	Reading	Listening	Speaking	Writing
score	28/30	28/30	22/30	22/30

Languages

- **Persian** (Native)
- **English** (Advanced)
- **Azerbaijani** (Native)
- **Arabic** (Novice Low)
- **Turkish** (Novice High)
- **German** (Beginner)

Awards and Honors

2019 Invited speaker to Iran-Turkey joint LHC conference with full support fund in Turkey

2017 Iran's National Elites Foundation Award for doing a scientific project in lieu of the compulsory military service

2017 Invited to participate in ICTP particle physics summer school with full support fund in Italy

2016 Invited to participate in ICTP cosmology summer school with half support fund in Italy

2014 Iran's National Elites Foundation Award

2015 Top 5 participants in Scientific Olympiad for University Students in Physics, Iran

2013 Ranked 10 among 6000 participants in the Nationwide Graduate Entrance Exam in Physics, Iran

2008 Renked 418 (12 by region) among 319,259 participants in the Nationwide University Entrance Qualification Test (similar to SAT)

2007 Qualified for the **final** stage of the National Mathematical Olympiad, Iran

References

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