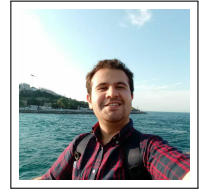# Javad Ebadi

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Personal Information and Contact

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Last Name	Ebadi
Date of Birth	09 September 1990
Address	School of Physics, Institute for Research in Fundamental Sciences (IPM), next to Kouhe Nour Building, Farmanieh Ave.
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Github	https://github.com/javadebadi, https://github.com/javadebadi1990

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

2019 I was involved in CMS experiment at CERN for 5 months. The analysis was "single top plus photon" channel. The job was made up of a few 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 avaialbe 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 situation. The other part of the job 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. In collaboration with my supervisor and Sara Khatibi, we suggested new channels to study theses 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. I learned MadGraph and generated sample of events for various couplings at the LHC. I used Pythia to shower and hadronize. Then, passed the vents to Delphes for detector simulation in CMS detector. The analysis of events was done using root-cern data analysis framework. I did 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

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.

2019 **High School Physics**.

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

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 280 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.

Publications

○ **On the effective couplings of Higgs**
In preperation

○ **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.
CERN-LPCC-2018-03

○ **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++ (4 years of experience), Python, Java, Bash scripting

○ **Version Control Systems (VCS):** Git, Github

○ **Notebooks:** Jupyter-Notebook

○ **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**

- ○ **Data Cleaning and Pre-processing**
- ○ **Data Visualization:** 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 1:41 AM GMT (91.8%) (Link)

2018 **Machine Learning** by Stanford University on Coursera. Certificate earned at Thursday, September 26, 2019 1:15 AM GMT (98.4%) (Link)

2019 **Neural Networks and Deep Learning** by deeplearning.ai on Coursera. Certificate earned at Monday, October 21, 2019 11:13 AM GMT (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 7:14 PM GMT (100%) (Link)

2019 **Python for Data Science and AI** by Joseph Santarcangelo, IBM on Coursera. Certificate earned at Sunday, November 24, 2019 5:11 PM GMT (100%) (Link)

2019 **Data Analysis with Python** by Joseph Santarcangelo, IBM on Coursera. Certificate earned at Sunday, December 29, 2019 7:37 AM GMT (100%) (Link)

Selected Seminars and Talks

- ○ **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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