

# Curriculum Vitae

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## **Personal Data:**

Name: Zahra  
Surname: Faraei  
Nationality: Iranian  
Gender: Female  
Date of birth: Mar. 21, 1979  
Marital status: Married, Two children  
Address: Institute for Advanced Studies in Basic Sciences (IASBS)  
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## **Career:**

**Visiting Researcher:** (July - Sept. 2023) The Abdus Salam International Centre for Theoretical Physics (ICTP), Trieste, Italy.

**Assistant Professor:** (Oct. 2020 - present) Dept. of Physics, Institute of Advanced Studies in Basic Sciences (IASBS).

**Visiting Researcher:** (May - July. 2019) The Abdus Salam International Centre for Theoretical Physics (ICTP), Trieste, Italy.  
Leader: Prof. Rosario Fazio  
Subject: Josephson current through tilted Graphene.

**Post Doc:** (June. 2016 – Oct. 2020) Department of Physics, Sharif University of Technology, Tehran, Iran  
Leader: Dr. Akbar Jafari  
Subject: Superconductivity in three dimensional Dirac and Weyl semimetals.

**Visiting Researcher:** (Apr. 2016 – June. 2016) School of Physics, Institute for Research in Fundamental Sciences (IPM), Tehran, Iran.  
Leader: Dr. S. Akbar Jafari  
Subject: Proximity effect in Dirac materials.

**Adjunct Lecturer:** (Sept. 2014 – Jul. 2015) Alzahra University, Tehran, Iran

**Parental leave:** (Mar. 2013 – Sept. 2016)

**PhD:** (Jan. 2007 – Feb. 2013) Alzahra University, Tehran, Iran

Supervisor: Dr. S. Akbar Jafari (SUT, Tehran, Iran)

Dr. Vahid Daadmehr (AU, Tehran, Iran)

Subject: Superconducting proximity effects in Carbon nanotubes.

**Adjunct Lecturer:** (Sept. 2004 – Jul. 2005) IAU, Qom, Iran

**Adjunct Lecturer:** (Sept. 2003 – Jul. 2004) IAU, Mashhad, Iran

**MSc:** (Sept. 2000 – Apr. 2003) Institute for Advanced Studies in Basic Sciences (IASBS), Zanjan, Iran.

Supervisor: Dr. Malek Zareyan (IASBS, Zanjan, Iran)

Subject: Proximity of Unconventional Superconductors and Ferromagnets.

**BSc:** (Sept. 1996 – Jul. 2000) Ferdowsi University, Mashhad, Iran

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### **Research interest:**

- Topological superconductors
- Weyl and Dirac superconductors
- Weyl antiferromagnets
- Dirac materials in two and three dimensions
- Weyl semimetals
- Pseudo-scalar superconductivity
- Tilted cone Dirac and Weyl materials
- Quantum transport
- Proximity Effects of Superconductors

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### **Teaching experience:**

Quantum Mechanics (main reference: Modern Quantum Mechanics - Sakurai and Napolitano)

Superconductivity (main reference: Introduction to superconductivity - Tinkham)  
Condensed matter Physics (main reference: The Oxford Solid State Basics - Simon)

Fundamentals of physics I, Mechanics (main reference: Fundamentals of Physics – Halliday and Resnick)

Fundamentals of physics II, Electromagnetics (main reference: Fundamentals of Physics – Halliday and Resnick)

Mechanics and Electromagnetic Labs

Modern physics

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## **Students Advised:**

### **MSc students**

1. IASBS – subject: Exploring scalar and pseudoscalar superconductivity in higher-order Weyl superconductors (in progress).
2. IASBS – subject: Anderson-Higgs mechanism in Weyl superconductors (in progress).
3. IASBS – subject: Exploring protected phase qubits in Josephson junction arrays (in progress).
4. IASBS – subject: Design and analysis of magnet parameters for magnet-assisted synchronous reluctance motors with optimized average torque and low torque ripple.
5. Alzahra University - subject: Fabrication and Characterization of BSSCO with Bismuth as an add-atom.
6. Alzahra University – subject: Fabrication and Characterization of  $\text{Bi}_2\text{Se}_3$
7. Alzahra University – subject: Effects of Ag nanoparticles as additive in BSSCO.
8. Alzahra University - subject: Electronic band energy of Bismuth

### **PhD students:**

1. M. H. Pakzamid – IASBS – subject: Magnon-related topological and quantum effects, and their interplay with electronic properties (in progress).
2. S. Zareei - Alzahra University - subject: The influence of atomic vacancies on the properties of Carbon nano-ribbons.
3. A. Mohajerani – Tarbiat modarres University – subject: Magnetic Susceptibility in Dirac superconductors

## **Journal Papers and Conference Contributions:**

- Z.Faraei and S. A. Jafari; “Synthetic complex Weyl superconductors, chiral Josephson effect and synthetic half-vortices”, [Sci Rep \(2023\) 13, 17976](#).
- Z.Faraei and S. A. Jafari; “Perpendicular Andreev reflection: Solid state signature of black hole horizon”, [Progress in Nanoscale and Low-Dimensional Materials and Devices: Properties, Synthesis, Characterization, Modelling and Applications](#), Springer International Publishing, pages 607-640 (2022).
- Z. Faraei, “Electric motors: Introduction, application and a basic challenge”, **Invited Speaker**, [27<sup>th</sup> Special School on Topics in Physics](#) (Jul. 2022), Institute of Advanced Studies in Basic Sciences (IASBS), Zanjan, Iran.
- A. Mohajerani, Z. Faraei, and S. A. Jafari; “Fast nuclear spin relaxation rates in tilted cone Weyl semimetals: Redshift factors from Korringa relation”, [J. Phys. Condens. Matter \(2021\) 33 215603](#).
- S Zarei, V Daadmehr, H Hakimi Pajouh, Z Faraei; “Effect of vacancy defects on the Josephson current in zigzag graphene narrow strips”, [Journal of Interfaces, Thin Films, and Low dimensional systems 4 \(2021\) 393-403](#).
- Z. Faraei and S. A. Jafari; “Electrically charged Andreev modes in two-dimensional tilted Dirac cone systems”, [Phys. Rev. B 101 \(2020\) 214508](#).
- Z. Faraei and S. A. Jafari; “Perpendicular Andreev reflection: Solid state signature of black hole horizon”, [Phys. Rev. B 100 \(2019\) 245436](#).
- Z. Faraei, S. A. Jafari and R. Fazio, “Charged Andreev modes in tilted Dirac cone systems”, **Poster**, Conference on Signatures of Topology in Condensed Matter (Oct. 2019), ICTP, Trieste, Italy.
- F. Adinehvand, Z. Faraei, T. Farajollahpour and S. A. Jafari; “Sound of Fermi arcs: a linearly dispersing gapless surface plasmon mode in undoped Weyl semimetals”, [Phys. Rev. B 100 \(2019\) 195408](#) .

- Z. Faraei, ICTP summer school, “Advanced in Condensed Matter Physics: New Trends and Materials in Quantum Technologies” (May. 2019), Samarkand, Uzbekistan.
- Z. Faraei and S. A. Jafari; “Induced superconductivity in Fermi arcs”, [Phys. Rev. B \*\*100\*\* \(2019\) 035447.](#)
- T. Farajollahpour, Z. Faraei, and S. A. Jafari; “The 8Pmmn borophene sheet: A solid-state platform for space-time engineering”, [Phys. Rev. B \*\*99\*\* \(2019\) 235150.](#)
- Z. Faraei, T. Farajollahpour, and S. A. Jafari; “Green’s function of semi-infinite Weyl semimetals”, [Phys. Rev. B \*\*98\*\* \(2018\) 195402.](#)
- A. Mohajerani, Z. Faraei, and S. A. Jafari; “NMR diagnosis of pseudo-scalar superconductivity in 3D Dirac materials”, [J. Phys. Condens. Matter \*\*30\*\* \(2018\) 50LT01.](#)
- Z. Faraei, S. A. Jafari “proximity induced superconductivity in three dimensional Dirac materials: odd-frequency, pseudo-scalar, pseudo-vector and tensor-valued superconducting orders”, [Phys. Rev. B \*\*96\*\* \(2017\) 134516.](#)
- Z. Faraei “Induced superconductivity in Weyl semimetals”, **Key talk**, Annual Physics Conference of Iran (Aug. 2018), Imam Khomeyni International University of Qazvin, Iran
- Z. Faraei “Landau quantization of Fermi arcs”, **Poster**, 24<sup>th</sup> Annual IASBS meeting on Condensed matter physics & school on complex systems (June 2018)
- Z. Faraei “Proximity induced p-wave superconductivity in the bulk of the three-dimensional Dirac materials”, **Talk**, 5<sup>th</sup> National Conference on Advanced on Superconductivity (May 2016)
- Z. Faraei, S.A. Jafari and V. Daadmehr, “Josephson current through randomly oriented CNTs”, [Physica C \*\*471\*\* \(2011\) 458](#)
- Z. Faraei, “Josephson current in superconductor-carbon nanotube layered

structures”, **Invited Speaker**, 2<sup>nd</sup> SERL Conference on Applied superconductivity (Feb. 2011), Sharif University of Technology, Tehran, Iran

- Z. Faraei, S.A. Jafari and V. Daadmehr, “Josephson current in SNS heterostructures”, **Talk**, 11<sup>th</sup> Annual Physics Conference of Iran (Sept. 2010), University of Shiraz, Shiraz, Iran
- Z. Faraii and M. Zareyan, “Unconventional superconducting states induced in a ferromagnet by a d-wave superconductor”, [Phys. Rev. B \*\*69\*\* \(2004\) 014508](#)