# 汪子博

浙江省宁波市
中山东路1299弄160号
电话: 13732172916
wangz57@rpi.edu

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## 教育经历

- 伦斯勒理工学院, 博士 (在读).
  **专业**: 物理.
  当前**平均绩点**: 4.00/4.00

- 迈阿密大学, 理学硕士 (2021).
  **专业**: 物理.
  **毕业论文**: Quantum Optical Models of Photosynthetic Reaction Centers: A Quantum Heat Engine Perspective (导师: Dr. Imram Mirza)
  **研究方向**: 量子光学, 量子信息.
  **平均绩点**: 4.00/4.00

- 罗斯霍曼理工学院, 理学学士 (2019).
  **专业**: 物理, 数学;
  **辅修**: 天文, 计算科学.
  **平均绩点**: 3.82/4.00. Magna Cum Laude.

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## 研究经验

### 硕士课题

- Quantum Heat Engine (QHE) Model of Photosynthetic Reaction Center (2021)
  Modeled photosynthetic reaction center as a QHE to explain its high efficiency.

- Coherent Perfect Absorption (CPA) in Cavity QED (2021)
  Investigated the conditions for CPA in an optical cavity coupled with atoms.

### 本科课题

- Asteroid Photometry (2018)
  Measured light curves for minor planets (Arthurmiller, Gantrisch, Mikawa, Oishi, Rubtsov, 1990 US4, and 1999 JX37).

### Class Projects

- Multi-atom Cavity Quantum Electrodynamics (2020, PHY651 - Quantum Optics)
  Studied the dynamics of multiple atoms interacting with a multi-mode ring cavity.
  课题报告链接

- Mathematics Behind the Standard Model (2019, MA498 - Thesis)
  Derived Klein-Gordon, Dirac, and Proca Equation form symmetries and groups, and studied particles interactions and the origin of mass.
  课题报告链接

- Modeling Different Physical Process Using MATLAB (2019, MA342 - Computational Modeling)
  Modeled 2D Coutte Flows, Ising Model, 2D heat equation, simulation of three-body problem, and etc.
  课题报告链接: I, II, III, IV, V, VI.

- Hydrogen Wave Equation (2018, MA436 - Intro to Partial Differential Equation)
  Studied partial differential equation arising from quantum theory of hydrogen atom, and examined the well posedness of the solution.
  课题报告链接

- Quantum Game Theory (2018, MA490 - Quantum Computation)
  Researched quantum games, specifically on quantum prisoner's dilemma.
  课题报告链接

- Quantum Entanglement and Applications (2018, PH402 - Intro to Atomic Physics)
  Researched entanglement and applications such as quantum teleportation and superdense coding.
  课题报告链接

- Determination of Orbital Elements of an Asteroid (2017, PH332 - Celestial Mechanics)
  Determined orbital elements of an asteroid by analyzing visual data using Maple and MATLAB.

- Determination of the Band-gap of Semiconductors (2017, PH325 - Advanced Lab I)
  Used an op-amp circuit with an Arduino board to determine the Band-gap of different semiconductors.
  课题报告链接

- Numerical Method for Electric Potential (2016, MA373 - Applied Linear Algebra)
  Applied finite element methods to study electric static potential.
  课题报告链接

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## 教学经验

- 2021 - 当前, 伦斯勒理工学院
  担任 PHYS 1100 物理 I, PHYS 2210 量子物理 I, PHYS 4810 计算物理 助教.

- 2019 - 2021, 迈阿密大学
  担任 PHY 191 物理 I, 192 物理 II 助教.
  授课 PHY 103, 物理实验概念.

- 2016 - 2019, 罗斯霍曼理工
  担任 PH 113, 物理 III; PH 292, 物理光学; PH 332, 天体力学.; PH 405, 半导体材料与应用; PH 410, 量子力学导论 评分员.

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## 发表

- Z Wang, et al. "Non-Markovianity in photosynthetic reaction centers: A nosie-induced quantum coherence perspective" arXiv preprint arXiv:2204.05901 (2022).
  URL: https://arxiv.org/abs/2204.05901

- Z Wang, et al. "Coherent Perfect Absorption in Tavis-Cummings Models" Optics Express 30 (6), 9360-9379 / arXiv preprint arXiv:2108.05917 (2022).
  URL: https://arxiv.org/abs/2108.05917

- Z Wang. "Quantum Optical Models of Photosynthetic Reaction Centers: A Quantum Heat Engine Perspective" Diss. Miami University (2021).
  URL: https://etd.ohiolink.edu/apexprod/rws_olink/r/1501/10?clear=10&p10_accession_num=miami1626968994170585

- Z Wang, I Mirza. "Dissipative Five-level Quantum Systems: A Quantum Model of Photosynthetic Reaction Centers", *Frontiers in Optics / Laser Science*, B. Lee, C. Mazzali, K. Corwin, and R. Jason Jones, eds., OSA Technical Digest (Optical Society of America, 2020), paper JM6B.26.
  URL: https://www.osapublishing.org/abstract.cfm?uri=LS-2020-JM6B.26

- R Ditteon, D Johnson, W Lin, **Z Wang**, B Zhao (equally contributed). "Lightcurve Analysis of Minor Planets Observed at the Oakley Southern Sky Observatory:2018 August - September", *The Minor Planet Bulletin*, Volume 46-4, pages 280-282 (2019).
  URL: http://articles.adsabs.harvard.edu/cgi-bin/nph-iarticle_query?2019MPBu...46..280D&data_type=PDF_HIGH&whole_paper=YES&type=PRINTER&filetype=.pdf

### 学术会议

- Oral presentation "Non-Markovian Models for Photosynthetic Reaction Center", OSAPS Spring meeting 2021.
  URL for the Abstract: https://meetings.aps.org/Meeting/OSS21/Session/B03.3
  PDF version: http://absimage.aps.org/image/OSS21/MWS_OSS21-2021-000014.pdf

- Poster presentation "https://science.sciencemag.org/content/316/5830/1462.abstract", APS March meeting 2021.
  URL for the Abstract: http://meetings.aps.org/Meeting/MAR21/Session/H71.273

- Oral presentation "Do Plants Know How to Behave Like a Quantum Computer While Performing Photosynthesis?", Miami University Graduate Research Forum. (2020)
  URL for the Video : https://youtu.be/4UcIQHB6WKg

- Oral presentation "Quantum Coherence in Photosynthetic Reaction Centers: A Quantum Heat Engine Perspective", OSAPS Fall meeting 2020.
  URL for the Abstract: http://meetings.aps.org/Meeting/OSF20/Session/C02.7
  PDF version: http://absimage.aps.org/image/OSF20/MWS_OSF20-2020-000005.pdf

- Poster presentation "Dissipative Five-level Quantum Systems: A Quantum Model of Photosynthetic Reaction Centers", Frontiers in Optics + Laser Science (Fio + LS). (2020)
  URL for the Abstract: https://www.osapublishing.org/abstract.cfm?uri=fio-2020-JM6B.26

- Oral presentation "Coherent Perfect Absorption in Cavity Quantum Electrodynamics", Miami University Physics Seminar Series. (2020)
  Seminar Flyer

- Attended Midwest Cold Atom Workshop (MCAW). (2019)

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## 荣誉

- 会员; Sigma Pi Sigma (物理荣誉社团)

- 会员; American Physical Society (美国物理学会)

- 2019
  John W. Rhee Memorial Award to the Outstanding Senior Physics Major (杰出物理大四学生)
- 2016
  C. Leroy Mason Physics Award to the Outstanding Sophomore Physics Major (杰出物理大二学生)

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## 证书和其他技能

### 证书

mini MBA, 迈阿密大学

### 软件

Adobe Photoshop, Eclipse, Logger Pro, Maple, Microsoft Office, Solidworks, and Visual Studio.

### 编程/标记语言

Arduino, HTML, LaTeX, **MATLAB** (证书: 基础, 机器学习), and R.

# Zibo Wang

30 Starbuck Dr.,
Apt 211,
Green Island, NY
Tel: (812) 223-4908
wangz57@rpi.edu

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## Education

- Ph.D. Rensselaer Polytechnic Institute, NY (in progress).
  **Major**: Physics.
  Current **GPA**: 4.00/4.00

- M.S. Miami University, OH (2021).
  **Major**: Physics.
  **Dissertation**: Quantum Optical Models of Photosynthetic Reaction Centers: A Quantum Heat Engine Perspective
  **Research Background**: Quantum optics and quantum information.
  Working in Mirza Research Group.
  **GPA**: 4.00/4.00

- B.S. Rose-Hulman Institute of Technology, IN (2019).
  **Majors**: Physics and Mathematics;
  **Minors**: Astronomy and Computational Science.
  **GPA**: 3.82/4.00. Magna Cum Laude.

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## Research Experience

### Master Projects

- Quantum Heat Engine (QHE) Model of Photosynthetic Reaction Center (2021)
  Modeled photosynthetic reaction center as a QHE to explain its high efficiency.

- Coherent Perfect Absorption (CPA) in Cavity QED (2021)
  Investigated the conditions for CPA in an optical cavity coupled with atoms.

### Undergraduate Project

- Asteroid Photometry (2018)
  Measured light curves for minor planets (Arthurmiller, Gantrisch, Mikawa, Oishi, Rubtsov, 1990 US4, and 1999 JX37).

### Class Projects

- Multi-atom Cavity Quantum Electrodynamics (2020, PHY651 - Quantum Optics)
  Studied the dynamics of multiple atoms interacting with a multi-mode ring cavity.
  Project Report Link

- Mathematics Behind the Standard Model (2019, MA498 - Thesis)
  Derived Klein-Gordon, Dirac, and Proca Equation form symmetries and groups, and studied particles

interactions and the origin of mass.
Project Report Link

- Modeling Different Physical Process Using MATLAB (2019, MA342 - Computational Modeling)
  Modeled 2D Coutte Flows, Ising Model, 2D heat equation, simulation of three-body problem, and etc.
  Project Report Link: I, II, III, IV, V, VI.

- Hydrogen Wave Equation (2018, MA436 - Intro to Partial Differential Equation)
  Studied partial differential equation arising from quantum theory of hydrogen atom, and examined the well posedness of the solution.
  Project Report Link

- Quantum Game Theory (2018, MA490 - Quantum Computation)
  Researched quantum games, specifically on quantum prisoner's dilemma.
  Project Report Link

- Quantum Entanglement and Applications (2018, PH402 - Intro to Atomic Physics)
  Researched entanglement and applications such as quantum teleportation and superdense coding.
  Project Report Link

- Determination of Orbital Elements of an Asteroid (2017, PH332 - Celestial Mechanics)
  Determined orbital elements of an asteroid by analyzing visual data using Maple and MATLAB.

- Determination of the Band-gap of Semiconductors (2017, PH325 - Advanced Lab I)
  Used an op-amp circuit with an Arduino board to determine the Band-gap of different semiconductors.
  Project Report Link

- Numerical Method for Electric Potential (2016, MA373 - Applied Linear Algebra)
  Applied finite element methods to study electric static potential.
  Project Report Link

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## Teaching Experience

- 2021 - present, Rensselaer Polytechnic Institute
  Teaching Assistant for PHYS 1100 Physics I, PHYS 2210 Quantum Physics I, PHYS 4810 Computational Physics.

- 2019 - 2021, Miami University
  Teaching Assistant for PHY 191 General Physics with Laboratory I, PHY 192 General Physics with Laboratory II.
  Instructor for PHY 103, Concepts in Physics Laboratory.

- 2016 - 2019, Rose-Hulman Institute of Technology
  Grader for PH 113, Physics III; PH 292, Physical Optics; PH 332, Celestial Mech.; PH 405, Semiconductor Material and App.; PH 410, Intro. to Quantum Mech.

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## Publications

- Z Wang, et al. "Non-Markovianity in photosynthetic reaction centers: A nosie-induced quantum coherence perspective" arXiv preprint arXiv:2204.05901 (2022).
  URL: https://arxiv.org/abs/2204.05901

- Z Wang, et al. "Coherent Perfect Absorption in Tavis-Cummings Models" Optics Express 30 (6), 9360-9379 / arXiv preprint arXiv:2108.05917 (2022).
  URL: https://arxiv.org/abs/2108.05917

- Z Wang. "Quantum Optical Models of Photosynthetic Reaction Centers: A Quantum Heat Engine Perspective" Diss. Miami University (2021).
  URL: https://etd.ohiolink.edu/apexprod/rws_olink/r/1501/10?clear=10&p10_accession_num=miami1626968994170585

- Z Wang, I Mirza. "Dissipative Five-level Quantum Systems: A Quantum Model of Photosynthetic Reaction Centers", *Frontiers in Optics / Laser Science*, B. Lee, C. Mazzali, K. Corwin, and R. Jason Jones, eds., OSA Technical Digest (Optical Society of America, 2020), paper JM6B.26.
  URL: https://www.osapublishing.org/abstract.cfm?uri=LS-2020-JM6B.26

- R Ditteon, D Johnson, W Lin, **Z Wang**, B Zhao (equally contributed). "Lightcurve Analysis of Minor Planets Observed at the Oakley Southern Sky Observatory:2018 August - September", *The Minor Planet Bulletin*, Volume 46-4, pages 280-282 (2019).
  URL: http://articles.adsabs.harvard.edu/cgi-bin/nph-iarticle_query?2019MPBu...46..280D&data_type=PDF_HIGH&whole_paper=YES&type=PRINTER&filetype=.pdf

**Conferences and Presentations**

- Oral presentation "Non-Markovian Models for Photosynthetic Reaction Center", OSAPS Spring meeting 2021.
  URL for the Abstract: https://meetings.aps.org/Meeting/OSS21/Session/B03.3
  PDF version: http://absimage.aps.org/image/OSS21/MWS_OSS21-2021-000014.pdf

- Poster presentation "https://science.sciencemag.org/content/316/5830/1462.abstract", APS March meeting 2021.
  URL for the Abstract: http://meetings.aps.org/Meeting/MAR21/Session/H71.273

- Oral presentation "Do Plants Know How to Behave Like a Quantum Computer While Performing Photosynthesis?", Miami University Graduate Research Forum. (2020)
  URL for the Video : https://youtu.be/4UcIQHB6WKg

- Oral presentation "Quantum Coherence in Photosynthetic Reaction Centers: A Quantum Heat Engine Perspective", OSAPS Fall meeting 2020.
  URL for the Abstract: http://meetings.aps.org/Meeting/OSF20/Session/C02.7
  PDF version: http://absimage.aps.org/image/OSF20/MWS_OSF20-2020-000005.pdf

- Poster presentation "Dissipative Five-level Quantum Systems: A Quantum Model of Photosynthetic Reaction Centers", Frontiers in Optics + Laser Science (Fio + LS). (2020)
  URL for the Abstract: https://www.osapublishing.org/abstract.cfm?uri=fio-2020-JM6B.26

- Oral presentation "Coherent Perfect Absorption in Cavity Quantum Electrodynamics", Miami University Physics Seminar Series. (2020)
  Seminar Flyer

- Attended Midwest Cold Atom Workshop (MCAW). (2019)

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## Honors and Memberships

- Member; Sigma Pi Sigma (The physics honor society)

- Member; American Physical Society (APS)

- 2019
  John W. Rhee Memorial Award to the Outstanding Senior Physics Major

- 2016
  C. Leroy Mason Physics Award to the Outstanding Sophomore Physics Major

## Certificates and Other Skills

### Certificate

Certification in miniMBA, Miami University

### Software

Adobe Photoshop, Eclipse, Logger Pro, Maple, Microsoft Office, Solidworks, and Visual Studio.

### Programing/Markup Language

Arduino, HTML, LaTeX, **MATLAB** (certificate: basic, machine learning), and R.

RECORD OF: Wang, Zibo 801332518
BIRTH DATE: 16-OCT
ENTERED: 03-SEP-2015
LEVEL: Undergraduate
GRADUATED: 25-MAY-19 DEG/CURR: BS-PH/MA MAGNA CUM LAUDE

NOTES: Double Major: PH/MA (CC 01/2018)
Minor In Astronomy
Minor In Computational Science

CREDIT BY EXAM or TRANSFER CREDIT HOURS ACCEPTED BY RHIT:

| | | | |
|---|---|---|---|
| From Credit By Exam | | | |
| CHEM 114 | Chemistry II from Chem Honors | | 3 CrHrs |
| MA 111 | Calculus I | | 5 CrHrs |
| PH 111 | Physics I | | 4 CrHrs |
| PH 112 | Physics II | | 4 CrHrs |
| From Univ of Elec Sci & Tech of CHN | | | |
| IA 000 | IA Elective in HSS | (ARTH106) | 4 CrHrs |
| SV 150 | Intro to Microeconomic | (ECO101) | 4 CrHrs |
| SV 171 | Principles of Psych | (PSY100) | 4 CrHrs |
| From Jinan University | | | |
| GS 000 | GS Elective in HSS | (A350) | 4 CrHrs |
| GS 163 | International Relations | (P110) | 4 CrHrs |
| IA 000 | IA Elective in HSS | (A200) | 4 CrHrs |
| From Approved Course Substitution | | | |
| MA 371 | MA373 for MA371 | | 4 CrHrs |

DATE ISSUED: 12-AUG-19

| Fall - 2015-16 | | PH | RWL | Grade | CrHrs |
|---|---|---|---|---|---|
| CHEM112 | General Chemistry Honors | | | A | 5 |
| CLSK100 | College & Life Skills | | | A | 1 |
| CLSK121 | College English | | | C | 4 |
| EM104 | Graphical Communications | | | A | 2 |
| MA112 | Calculus II | | | A | 5 |
| TERM | GPA: 3.52 | Points: 60.0 | GPA Hrs: 17.0 | | |
| CUM | GPA: 3.52 | Points: 60.0 | GPA Hrs: 17.0 | | |
| CR HRS | Total: 33.0 | | RHIT: 33.0 | | |

| Winter - 2015-16 | | PH | RWL | Grade | CrHrs |
|---|---|---|---|---|---|
| CSSE120 | Intro to Software Development | | | A | 4 |
| MA113 | Calculus III | | | A | 5 |
| PH113 | Physics III | | | A | 4 |
| RH131 | Rhetoric and Composition | | | B+ | 4 |
| TERM | GPA: 3.88 | Points: 66.0 | GPA Hrs: 17.0 | | |
| CUM | GPA: 3.70 | Points: 126.0 | GPA Hrs: 34.0 | | |
| CR HRS | Total: 50.0 | | RHIT: 50.0 | | |

| Spring - 2015-16 | | PH | RRL | Grade | CrHrs |
|---|---|---|---|---|---|
| CHEM115 | General Chemistry III | | | A | 3 |
| CHEM115L | General Chemistry III Lab | | | B+ | 1 |
| MA211 | Differential Equations | | | A | 4 |
| MA212 | Matr Alg & Sys of Diff Equ | | | A | 4 |
| PH290 | Physics of Music | | | A | 4 |
| TERM | GPA: 3.96 | Points: 63.5 | GPA Hrs: 16.0 | | |
| CUM | GPA: 3.79 | Points: 189.5 | GPA Hrs: 50.0 | | |
| CR HRS | Total: 78.0 | | RHIT: 66.0 | | |

| Fall - 2016-17 | | PH | RRL | Grade | CrHrs |
|---|---|---|---|---|---|
| MA275 | Discrete & Combinatorial Alg I | | | B+ | 4 |
| PH235 | Many-Particle Physics | | | A | 4 |
| PH292 | Physical Optics | | | A | 4 |
| PH292L | Physical Optics Lab | | | NG | 0 |
| PH310 | Intro to Special Relativity | | | B | 2 |
| PH316 | Electric & Magnetic Fields | | | A | 4 |
| TERM | GPA: 3.77 | Points: 68.0 | GPA Hrs: 18.0 | | |
| CUM | GPA: 3.78 | Points: 257.5 | GPA Hrs: 68.0 | | |
| CR HRS | Total: 96.0 | | RHIT: 84.0 | | |

| Winter - 2016-17 | | PH | RRL | Grade | CrHrs |
|---|---|---|---|---|---|
| MA373 | Appl Linear Algebra for Engr | | | A | 4 |
| MA375 | Discrete & Comb Algebra II | | | A | 4 |
| PH241 | Physics of Stars | | | A | 4 |
| PH255 | Foundations of Modern Physics | | | A | 4 |
| PH317 | Electromagnetism | | | A | 4 |
| TERM | GPA: 4.00 | Points: 80.0 | GPA Hrs: 20.0 | | |
| CUM | GPA: 3.83 | Points: 337.5 | GPA Hrs: 88.0 | | |
| CR HRS | Total: 116.0 | | RHIT: 104.0 | | |

| Spring - 2016-17 | | PH | RRL | Grade | CrHrs |
|---|---|---|---|---|---|
| MA336 | Boundary Value Problems | | | A | 4 |
| MA381 | Intro Problty w/ Appl to Stats | | | A | 4 |
| PH314 | Theoretical Mechanics I | | | A | 4 |
| PH322 | Celestial Mechanics | | | B+ | 4 |
| PH325 | Adv Physics Laboratory I | | | B+ | 4 |
| PH327 | Thermodynamics & Stat Mech | | | A | 4 |
| TERM | GPA: 3.83 | Points: 92.0 | GPA Hrs: 24.0 | | |
| CUM | GPA: 3.83 | Points: 429.5 | GPA Hrs: 112.0 | | |
| CR HRS | Total: 152.0 | | RHIT: 128.0 | | |

| Fall - 2017-18 | | PH | RRL | Grade | CrHrs |
|---|---|---|---|---|---|
| CHEM225 | Analytical Chemistry I | | | A | 3 |
| CHEM225L | Analytical Chemistry I Lab | | | B+ | 1 |
| JP111 | Japanese Language & Culture I | | | A | 4 |
| MA421 | Tensor Calc & Riemannian Geom | | | B | 4 |
| OE171 | Photography & Holography | | | A | 2 |
| PH231 | Observational Astronomy | | | A | 2 |
| PH405 | Semicond Materials & Applictns | | | A | 4 |
| TERM | GPA: 3.77 | Points: 75.5 | GPA Hrs: 20.0 | | |
| CUM | GPA: 3.82 | Points: 505.0 | GPA Hrs: 132.0 | | |
| CR HRS | Total: 172.0 | | RHIT: 148.0 | | |

| Winter - 2017-18 | | PH/MA | RRL | Grade | CrHrs |
|---|---|---|---|---|---|
| MA366 | Functions of a Real Variable | | | C | 4 |
| PH401 | Intro to Quantum Mechanics | | | A | 4 |
| PH410 | General Relativity | | | B+ | 4 |
| PH425 | Advanced Physics Lab II | | | A | 4 |
| PH490 | Holography | | | A | 1 |
| TERM | GPA: 3.41 | Points: 58.0 | GPA Hrs: 17.0 | | |
| CUM | GPA: 3.77 | Points: 563.0 | GPA Hrs: 149.0 | | |
| CR HRS | Total: 189.0 | | RHIT: 165.0 | | |

| Spring - 2017-18 | | PH/MA | RRL | Grade | CrHrs |
|---|---|---|---|---|---|
| MA330 | Vector Calculus | | | A | 4 |
| OE450 | Laser Systems & Applications | | | A | 4 |
| PH250 | Planets and Galaxies | | | A | 4 |
| PH402 | Intro to Atomic Physics | | | A | 4 |
| PH470 | Relativity & Electromagnetism | | | A | 2 |
| TERM | GPA: 4.00 | Points: 72.0 | GPA Hrs: 18.0 | | |
| CUM | GPA: 3.80 | Points: 635.0 | GPA Hrs: 167.0 | | |
| CR HRS | Total: 207.0 | | RHIT: 183.0 | | |

CONTINUED NEXT PAGE ...

| Fall - 2018-19 | | PH/MA | GCD | Grade | CrHrs |
|---|---|---|---|---|---|
| MA332 | Intro to Computational Science | | | A | 4 |
| MA382 | Intro to Stats w/Probability | | | W | 0 |
| MA436 | Intro to Partial Diff Equation | | | B+ | 4 |
| MA490 | Quantum Computing | | | B+ | 4 |
| MA496 | Senior Thesis I | | | A | 4 |
| TERM | GPA: 3.75 | Points: 60.0 | GPA Hrs: 16.0 | | |
| CUM | GPA: 3.79 | Points: 695.0 | GPA Hrs: 183.0 | | |
| CR HRS | Total: 223.0 | | RHIT: 199.0 | | |

| Winter - 2018-19 | | PH/MA | GCD | Grade | CrHrs |
|---|---|---|---|---|---|
| JP112 | Japanese Language & Culture II | | | A | 4 |
| MA323 | Geometric Modeling | | | A | 4 |
| MA433 | Numerical Analysis | | | A | 4 |
| MA497 | Senior Thesis II | | | A | 2 |
| PH490 | Asteroid Photometry | | | A | 1 |
| TERM | GPA: 4.00 | Points: 60.0 | GPA Hrs: 15.0 | | |
| CUM | GPA: 3.81 | Points: 755.0 | GPA Hrs: 198.0 | | |
| CR HRS | Total: 238.0 | | RHIT: 214.0 | | |

| Spring - 2018-19 | | PH/MA | GCD | Grade | CrHrs |
|---|---|---|---|---|---|
| MA342 | Computational Modeling | | | A | 4 |
| MA498 | Senior Thesis III | | | A | 2 |
| OE470 | Intro to Quantum Optics | | | A | 4 |
| PH315 | Theoretical Mechanics II | | | A | 4 |
| PH407 | Solid State Physics | | | A | 4 |
| PH490 | Asteroid Photometry | | | B+ | 1 |
| TERM | GPA: 3.97 | Points: 75.5 | GPA Hrs: 19.0 | | |
| CUM | GPA: 3.82 | Points: 830.5 | GPA Hrs: 217.0 | | |
| CR HRS | Total: 257.0 | | RHIT: 233.0 | | |

Jan A. Pink, Registrar

# ROSE-HULMAN
## INSTITUTE OF TECHNOLOGY

5500 Wabash Avenue • Terre Haute, IN 47803
Office of the Registrar: (812) 877-8028 • Fax (812) 877-8141


**NAME OF INSTITUTION:** Changed from Rose Polytechnic Institute to Rose-Hulman Institute of Technology in 1971.

**ACCREDITATION:** Curricula in Biomedical Engineering, Chemical Engineering, Civil Engineering, Computer Engineering, Computer Science, Electrical Engineering, Engineering Physics, Mechanical Engineering Optical Engineering and Software Engineering are accredited by ABET. Rose-Hulman is accredited by the North Central Association of Colleges and Schools and by the Department of Public Instruction of the State of Indiana. The chemistry curriculum has been approved by the Committee on Professional Training of the American Chemical Society.

**LENGTH OF QUARTER:** 11 weeks

**REQUIRED FOR GRADUATION:** B.S. 188-198 credit hours (depending on major) with a 2.00 average. M.S. 51 credit hours with a 3.00 average

| Grades | | | | Credit Granted |
|---|---|---|---|---|
| A | = | 4.0 | Excellent | yes |
| B+ | = | 3.5 | | yes |
| B | = | 3.0 | Good | yes |
| C+ | = | 2.5 | | yes |
| C | = | 2.0 | Satisfactory | yes |
| D+ | = | 1.5 | | yes |
| D | = | 1.0 | Poor but passing | yes |
| F | = | 0 | Fail | no |
| WS | = | * | Withdrew Satisfactory | no |
| WF | = | ** | Withdrew Failing | no |
| W | = | * | Withdrew | no |
| S | = | * | Satisfactory (Pass/Fail course) | yes |
| U | = | * | Unsatisfactory (Pass/Fail course) | no |
| I | = | * | Incomplete | no |
| N | = | * | No Report | no |
| T or AU | = | * | Audit (no credit granted) | no |
| NG | = | * | Non-Gradeable Course | no |

* This grade is not used in calculating gpa.

** Counts as "F". The grade "WF" is assigned automatically when a student withdraws after the eighth week of a term unless there is a special exigency.

**TO TEST FOR AUTHENTICITY:** The face of this document has a red background with the name of the Institute in small white print, a uniform red border on all four sides, the registrar's signature in black, and a raised seal. A microprinted line appears near the bottom of the form. When held up to the light a watermark appears.

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**ABBREVIATIONS**

| | |
|---|---|
| AB | Applied Biology |
| AS | Air Science |
| AO | Applied Optics |
| BE | Biomedical Engineering |
| BC | Biochemistry major |
| BCMB | Biochemistry & Molecular Biology major |
| BIO | Biology |
| BMTH | Biomathematics |
| CE | Civil Engineering |
| CHE or CH | Chemical Engineering |
| CHEM or CM | Chemistry |
| CPE or CO | Computer Engineering |
| CLSK | College and Life Skills |
| CPLS | Computational Science |
| CS | Computer Science |
| CSSE | Computer Science Software Engineering |
| ECON or EC | Economics major |
| ECE or EC | EE/CO/CPE course prefix |
| EE | Electrical Engineering |
| EM | Engineering Mechanics |
| EMGT or MG | Engineering Management |
| EP | Engineering Physics |
| ES | Engineering Science |
| EVE or EV | Environmental Engineering |
| GEOL | Geology |
| GL | Global Studies |
| GRAD | Graduate Studies |
| GS | Global Studies |
| HU | Humanities |
| IA | Ideas and Art |
| ICS | International Computer Science |
| IS | International Studies major |
| LS | Life Science |
| MA | Mathematics |
| ME | Mechanical Engineering |
| MS | Military Science |
| OE | Optical Engineering |
| PH | Physics |
| RH | Rhetoric and Expression |
| ROBO | Robotics |
| SE or IFYC (Prior to 2003-2004) | Integrated Freshman Year Curriculum in Science, Engineering, and Mathematics |
| SE | Software Engineering |
| SEMI | Systems Engineering and Management (International Program) |
| SL | Self and Society |
| SO | Social Sciences |
| SV | Society and Values |
| VA | Values and Contemporary Issues |

Other Notations:

E = Exclude – Indicates the grade is excluded from GPA calculation

I = Include – Indicates the grade is included in the GPA calculation

R Grade replaced; lower grade ignored in computing gpa

**STUDENT STATUS** Good standing (eliglble to return) at time of last attendance is implied if not specifically indicated to the contrary under "Notes."

# MIAMI UNIVERSITY

Student ID *****2185

## Official Transcript

Date Issued: 11-MAY-2022

Record of: Zibo Wang
Issued To: ZIBO WANG



Course Level: Graduate

Program
Master of Science
College : College of Arts and Science
Major : Physics

Degree Awarded Master of Science 13-AUG-2021
College : College of Arts and Science
Major : Physics

Thesis
Quantum Optical Models of Photosynthetic Reaction Centers: A Quantum Heat Engine Perspective

| SUBJ | NO. | COURSE TITLE | CRED | GRD | PTS | R |
|---|---|---|---|---|---|---|
| INSTITUTION CREDIT: | | | | | | |
| Fall Semester 2019-20 | | | | | | |
| PHY | 500 | Physics Seminar | 1.00 | X | 0.00 | |
| PHY | 583 | Mathematical Methods In Physic | 4.00 | A | 16.00 | |
| PHY | 586 | Advanced Computational Physics | 3.00 | A | 12.00 | |
| PHY | 610 | Research | 1.00 | X | 0.00 | |
| PHY | 689 | Teaching Assistant Seminar | 1.00 | A | 4.00 | |
| PHY | 691 | Modern Quantum Physics | 4.00 | A+ | 16.00 | |
| Ehrs: 14.00 GPA-Hrs: 12.00 QPts: 48.00 GPA: 4.00 | | | | | | |
| GR Good Standing | | | | | | |
| Spring Semester 2019-20 | | | | | | |
| PHY | 500 | Physics Seminar | 1.00 | X | 0.00 | |
| PHY | 610 | Research | 1.00 | A+ | 4.00 | |
| PHY | 651 | Quantum and Nonlinear Optics | 3.00 | A | 12.00 | |
| PHY | 671 | Electromagnetism | 4.00 | A | 16.00 | |
| Ehrs: 9.00 GPA-Hrs: 8.00 QPts: 32.00 GPA: 4.00 | | | | | | |
| GR Good Standing | | | | | | |
| Summer Term 2019-20 | | | | | | |
| PHY | 677 | Independent Studies | 0.00 | A | 0.00 | |
| Ehrs: 0.00 GPA-Hrs: 0.00 QPts: 0.00 GPA: 0.00 | | | | | | |
| GR Good Standing | | | | | | |

********** CONTINUED ON NEXT COLUMN **********

| SUBJ | NO. | COURSE TITLE | CRED | GRD | PTS | R |
|---|---|---|---|---|---|---|
| Institution Information continued: | | | | | | |
| Fall Semester 2020-21 | | | | | | |
| PHY | 500 | Physics Seminar | 1.00 | X | 0.00 | |
| PHY | 610 | Research | 3.00 | A | 12.00 | |
| PHY | 620 | Topics In Modern Physics | 2.00 | A | 8.00 | |
| PHY | 642 | Adv Kinetic Thry&Stat Mechnics | 4.00 | A | 16.00 | |
| Ehrs: 10.00 GPA-Hrs: 9.00 QPts: 36.00 GPA: 4.00 | | | | | | |
| GR Good Standing | | | | | | |
| Spring Semester 2020-21 | | | | | | |
| PHY | 500 | Physics Seminar | 1.00 | X | 0.00 | |
| PHY | 542 | Spectroscopy-Atoms & Molecules | 4.00 | A | 16.00 | |
| PHY | 700 | Research For Masters Thesis | 6.00 | P | 0.00 | |
| Ehrs: 11.00 GPA-Hrs: 4.00 QPts: 16.00 GPA: 4.00 | | | | | | |
| GR Good Standing | | | | | | |
| Summer Term 2020-21 | | | | | | |
| PHY | 700 | Research For Masters Thesis | 3.00 | P | 0.00 | |
| Ehrs: 3.00 GPA-Hrs: 0.00 QPts: 0.00 GPA: 0.00 | | | | | | |
| GR Good Standing | | | | | | |

********** TRANSCRIPT TOTALS **********

| | Earned Hrs | GPA Hrs | Points | GPA |
|---|---|---|---|---|
| TOTAL INSTITUTION | 47.00 | 33.00 | 132.00 | 4.00 |
| TOTAL TRANSFER | 0.00 | 0.00 | 0.00 | 0.00 |
| OVERALL | 47.00 | 33.00 | 132.00 | 4.00 |

********** END OF TRANSCRIPT **********

Amanda L. Euen,
University Registrar

# MIAMI UNIVERSITY

Student ID *****2185

## Official Transcript

Date Issued: 11-MAY-2022

Record of: Zibo Wang
Issued To: ZIBO WANG



Course Level: Undergraduate

| SUBJ | NO. | COURSE TITLE | CRED | GRD | PTS | R |
|---|---|---|---|---|---|---|
| INSTITUTION CREDIT: | | | | | | |
| Spring Semester 2019-20 | | | | | | |
| KNH | 150E | Beginning Horseback Riding | 2.00 | X | 0.00 | |
| | Ehrs: 2.00 | GPA-Hrs: 0.00 | QPts: 0.00 | GPA: 0.00 | | |
| GR Good Standing | | | | | | |
| Fall Semester 2020-21 | | | | | | |
| ART | 155 | Beginning Drawing | 1.50 | A+ | 6.00 | |
| | Ehrs: 1.50 | GPA-Hrs: 1.50 | QPts: 6.00 | GPA: 4.00 | | |
| GR Good Standing | | | | | | |

********** TRANSCRIPT TOTALS **********

| | Earned Hrs | GPA Hrs | Points | GPA |
|---|---|---|---|---|
| TOTAL INSTITUTION | 3.50 | 1.50 | 6.00 | 4.00 |
| TOTAL TRANSFER | 0.00 | 0.00 | 0.00 | 0.00 |
| OVERALL | 3.50 | 1.50 | 6.00 | 4.00 |

********** END OF TRANSCRIPT **********

Amanda L. Euen,
University Registrar

教育部留学服务中心
Chinese Service Center for Scholarly Exchange

# 国外学历学位认证书

编号：120190073266

汪子博，男，中国国籍，出生于1996年10月16日。

汪子博在美国罗斯霍曼理工学院(Rose-Hulman Institute of Technology)学习，于2019年5月获得该校授予的理学学士学位，专业领域为物理学和数学。

经核查，罗斯霍曼理工学院系美国正规高等学校。汪子博所获理学学士学位表明其具有相应的学历。

教育部留学服务中心
国外学历学位认证
专用章

教育部留学服务中心

二〇一九年十月二十九日

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教育部留学服务中心
Chinese Service Center for Scholarly Exchange

# 国外学历学位认证书

编号：120220122289

汪子博，男，中国国籍，出生于1996年10月16日。

汪子博在美国迈阿密大学(俄亥俄州)(Miami University)学习，于2021年8月获得该校授予的理学硕士学位，专业领域为物理学。

经核查，迈阿密大学(俄亥俄州)系美国正规高等学校。汪子博所获理学硕士学位表明其具有相应的学历。

教育部留学服务中心
国外学历学位认证
专用章

教育部留学服务中心

二〇二二年五月十三日

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