THE GEORGE WASHINGTON UNIVERSITY
WASHINGTON, DC

Graduate Program in Physics

Columbian College of Arts and Sciences (CCAS)
https://columbian.gwu.edu/
Physics Department
https://physics.columbian.gwu.edu/

Admissions: Contact Info

Prof. Oleg Kargaltsev - graduate admissions coordinator in the Physics Department.

Physics-specific admission inquiries email me at:
gradappl@gwu.edu
This is a direct way to contact the Physics graduate admissions coordinator with questions about any aspects of GW physics program.

General inquiries about the graduate application procedure (e.g. how to report GRE/TOEFL scores, transcript eligibility, application fees, deferrals, visa issues, possibility to attend remotely for international students) should be directed to askccas@gwu.edu but you may also CC to gradappl@gwu.edu.

Admissions: Deadlines

For PhD in Physics program the deadline for Fall 2021 is:
January 15, 2021

For Master of Science (MS) in Physics the deadline is:

April 1, 2021

For Spring 2021 admissions the deadlines are October 1 (PhD) and **November 1 (MS)** 2020. The dates may change next year. Be sure to check these pages:

https://columbian.gwu.edu/graduate-applicants

https://columbian.gwu.edu/graduate-admissions-faq

Admissions: Requirements

Bachelor's degree in Physics (or equivalent; https://physics.columbian.gwu.edu/bs-physics).
Transcript, minimum undergraduate GPA: 3.0
GRE General (no strict cut-off score)
-- GRE subject (Physics) is **not** required
English test for international students (TOEFL/IELTS>80/6.0 but >100/7.0 for the TA positions!)
Statement of Purpose (about 1 page)
Letters of recommendation (3 for PhD, 2 for MS)
Evidence of financial support (if self-supported)

Please see

https://www.programs.gwu.edu/graduate/physics
https://columbian.gwu.edu/graduate-admissions-faq

before e-mailing with questions.

Required courses for our **BS** in Physics program.

CSCI 1012	Introduction to Programming with Python
or MAE 1117	Introduction to Engineering Computations
PHYS 1021	University Physics I
or PHYS 1025	University Physics I with Biological Applications
PHYS 1022	University Physics II
or PHYS 1026	University Physics II with Biological Applications
PHYS 2023	Modern Physics
MATH 1231	Single-Variable Calculus I
MATH 1232	Single-Variable Calculus II
MATH 2233	Multivariable Calculus
MATH 2184	Linear Algebra I
Advanced courses (46 credits)	
MATH 3342	Ordinary Differential Equations
PHYS 2151W	Intermediate Laboratory I: Techniques and Methods
PHYS 2152	Intermediate Laboratory II: Instrumentation
PHYS 3100	Math Methods for Physics
PHYS 3161	Mechanics
PHYS 3164	Thermal and Statistical Physics
PHYS 3165	Electromagnetic Theory I
PHYS 3166	Electromagnetic Theory II
PHYS 3167	Principles of Quantum Physics
PHYS 3181	Computational Physics
PHYS 4195W	Physics Capstone
PHYS 4196	Undergraduate Research in Biophysics
or PHYS 4197	Undergraduate Research in Nuclear Physics
or ASTR 4195	Undergraduate Research in Astrophysics
PHYS 4200	Physics Symposium

Admissions: Timeline

Spring 2021 applications will be reviewed in October (PhD) and November (MS). Decisions are announced shortly thereafter.

Fall 2021 applications PhD will be reviewed in late January (early February) but the offers may be sent in two rounds. Therefore, if you have not received the decision on your application in February, you *still have a chance to be admitted in March (or even April)* if an applicant from Tier 1 declines our offer.

It is very important to let us (myself by e-mail or CCAS via the link in your notification e-mail) know that you are not accepting our offer as soon as you decided. This allows us to make offers to others!

Admissions: Process

Your applications will be reviewed by the faculty from Physics Graduate Committee and ranked according to the combined vote of the Committee members.

Depending on the number of Teaching Assistantships and Fellowships available, first round of offers will be made to 10-15 applicants from Tier 1. Depending on responses from the Tier 1 applicants we may make more offers later. We usually do it.

For admitted applicants we plan to organize a separate opportunity to meet with our faculty and students. Typically, it would in person by visiting us but this Spring it will be done remotely.

Our Program: The Department

Vibrant, diverse, highly competitive research, solid education in physics with subsequent deep focus on a specific research area.

- 20 faculty – 10 came within last 10 years!
- >40 graduate students, taking 6 to 15 per year
- Median time to PhD: 5-6 years (average in US: 7 years)
- Retention: 70% (100% after Y1; average in US: 55%).
- Strong focus on research, connections with major research centers in DC/MD/VA area (NASA Goddard, Jefferson Lab, NIH, NRL,…), access to data from major world-class experiments and observatories, international collaboration, students start research early (work in the government labs, etc)
- Strong support for new students with faculty and senior student mentoring
- Diversity (e.g., currently 30% of our graduate students are non-male).

Our Program: The Department

- Rich history:
  George Gamow and *Edward Teller* are among the prominent GW Physics faculty.

  The Department (founded in 1912) has organized and hosted major scientific conferences including the meeting where Niels Bohr announced the first successful splitting on a uranium atom.

George Gamow
GW Professor of Physics
1934-1956

Edward Teller
GW Professor of Physics
1935-1945

Plaque originally outside Room 209 in Government Hall,
The George Washington University

- Our former PhD students work at NASA, JLAB, Harvard, Penn State, Mainz University, NFS, IBM, …

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Our Program: The Corcoran Hall

- Corcoran Hall (built in 1924) is the historic home of the Physics Department
- It has been completely renovated inside in 2017

Our Program: Science and Engineering Hall

- Physics Department faculty have access to the state-of-the-art labs in the recently built Science and Engineering Hall (home to the biophysics group) which also offers excellent classroom, discussion group, and meeting spaces available to all our students and faculty.

Our Program: Coursework

June	Informal Pre-test Math Skills; support of remedial self-study.			
Sem. 1	Theoretical Mechanics (Gen. Ex.) (4)	Computational Physics I (1)	Mathematical Methods (4)	Colloquium
Sem. 2	Quantum Mechanics I (Gen. Ex.) (4)	Computational Physics II (1)	Electrodynamics & Classical Fields (Gen. Ex.) (4)	Colloquium
Sem. 3	Quantum Mechanics II (4)	Computational Physics III (1)	Statistical Physics (Gen. Ex.) (4)	Colloquium
Sem. 4	Topics-In/ Research. Course (3)		Nuclear or Astro or Biophysics I (3)	Comm. Phys. (3) & Colloquium
	Before end of Sem. 5: PhD Proposal			

Our PhD program helps student to **transition to research early**:

- Funded summer research opportunities (starting in year 1)
- Specialized courses starting in 2nd year (4th semester) continuing in year 3
- Early placement in research projects involving external advisors (NASA, NRL, JLAB, etc) helps to build relationships and find jobs upon graduation
- PhD qualification exam is a “pass” if your core course grades are good.

Our Program: Coursework

In addition to **Astrophysics, Biophysics, Nuclear physics**, our specialized courses cover cross-disciplinary topics:

- Statistical methods, Machine Learning
- Complex systems analysis, Big data, Quantum Optics
- Mathematical methods, Computational Physics

Physics students can take advantage of Data Science and High-Performance Computing courses offered within CCAS and earn **professional certificates in Data Science and High-Performance Computing**.

GW is a part of Consortium of Universities of the Washington Metropolitan Area. This means that **you can take graduate courses at UMD, George Mason, Georgetown, American, UDC, and other universities**, if the course you are looking for is not available at GW. *These course credits count as if it would be taken at GW*.

Our Program: Student Financial Support

Traditionally most of our PhD students **are supported by Teaching Assistantships ($26,560 for 9 months + summer pay) during the first 2 years** while taking core courses. We make sure that students are able to stay in our program before they become fully engaged in the PhD research and related specialized courses. For students, it offers an opportunity to look around and try doing research with different faculty (e.g., during summer).

A limited number of CCAS fellowships is available to exceptional or minority applicants. Of course, there is always a self-support option ($1,765/credit hour).

MS students typically stay in our program for 2 years and are required to be self-supported (although CCAS may offer partial tuition fellowships to exceptional applicants). **It is possible to transition to PhD after MS** but the decisions are made on competitive basis including all external PhD applications.

During the 3rd year most students transition to Research Assistantships which are paid out of the faculty research grants. It means that students are supported by their PhD advisors and they have their PhD thesis topic selected during the 3rd year.

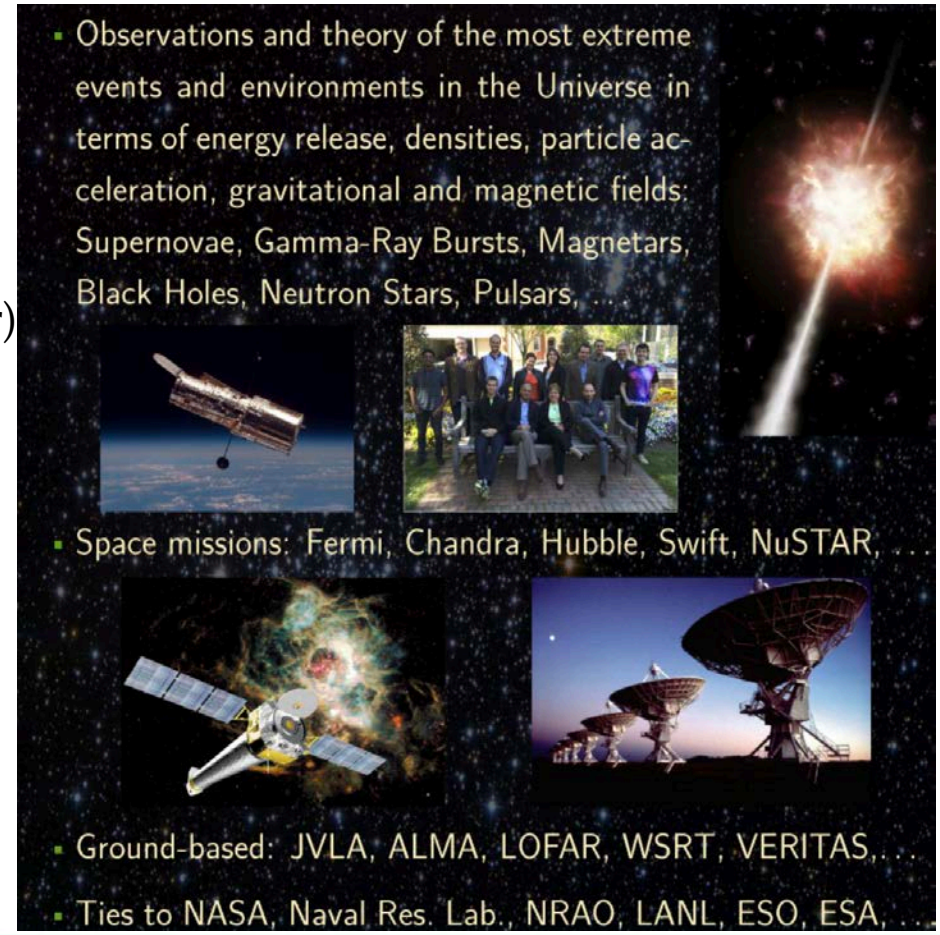
Our Program: Research Areas - Astrophysics

- Focus on **high-energy astrophysics**, close ties with NASA.

- Faculty:
  Bethany Cobb Kung
  Kalvir Dhuga
  Sylvain Guiriec
  Oleg Kargaltsev
  Chryssa Kouveliotou (NAS member, Chair)
  Alexander van der Horst
  George Younes

- Students: About 10 PhD students but the number is fluctuating and recently increased significantly.

- Recent job placements for PhD graduates:
  UC Berkley (postdoc)
  Penn State (postdoc)
  NASA GSFC (postdoc)

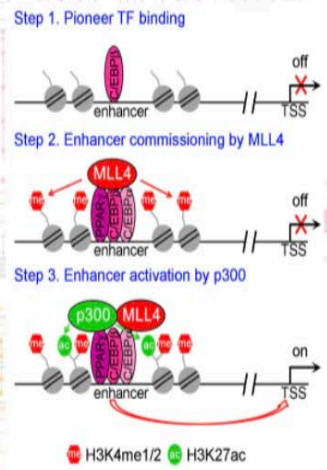


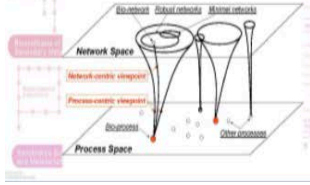
Our Program: Research Areas - Biophysics

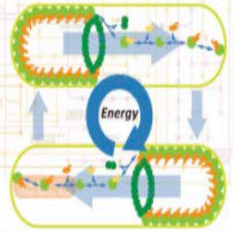
- Experimental, theoretical, and computational biophysics.
- Faculty: Neil Johnson, Weiqun Peng, Xiangyun Qiu, Mark Reeves, Chen Zeng
- Students: ~6 PhD and several MS students

Fundamental principles of complex biological processes

- Structures, dynamics and emergent behaviors at multiple spatial, temporal and organizational scales
- Cellular mechanics, thermodynamics of biological regulators
- Computational Biology, genomics and evolution
- Protein design & bionetwork modeling

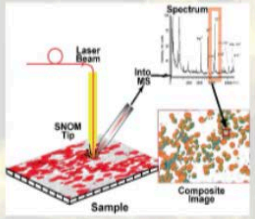


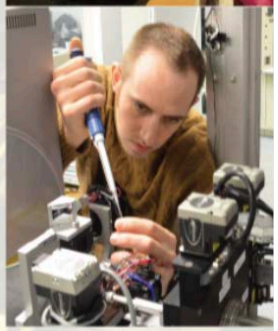




- Physics of DNA, RNA, proteins, . . .
- DNA with carbon-nanotubes, graphene; self-assembly
- Single-cell biosensors & metabolomics
- Biochemical pathways in living cells
- In-house small- & wide-angle X-ray; user at NIST, NRL, ANL, BNL,. . .

Working with GW Biology, Chemistry, Engineering, Medical School

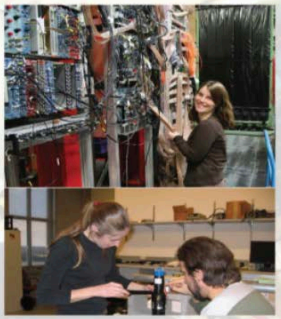




Our Program: Research Areas – Nuclear Physics

- Experimental and theoretical nuclear physics.
- Faculty: Andrei Afanasev, Andrei Alexandru, William Briscoe, Michael Doering, Evangeline Downie, Gerald Feldman, Harald Griesshammer, Helmut Haberzettl, Frank Lee, Axel Schmidt
- >10 PhD students, research opportunities at JLAB, Mainz (Germany), LHC.

- **Structure of the nucleon:** radii, polarizabilities, form factors
- **Hadron Resonances:** nucleon excitations, medium effects
- **Fundamental Symmetries:** parity violation and beyond

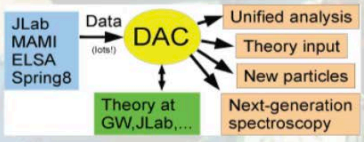


Hadron, lepton, photon beams:
Jefferson Lab (Newport News, VA),
HIγS (Durham, NC), MAMI (Germany)
PSI (Switzerland),...

Data Analysis Center

Profs. Briscoe, Doring, Haberzettl, Strakovsky, Workman

Home of the SAID Partial-Wave Analysis Facility



Theory & experiment intersect

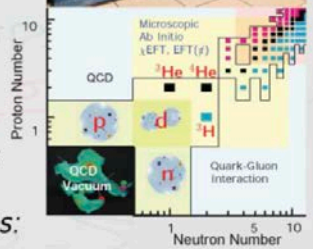
Baryon and meson spectroscopy:
exotic states, glueballs,...

Nuclear Physics from the Standard Model

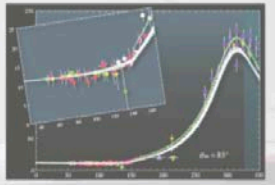
Lattice QCD: pioneer GPUs, QCD vacuum, high-density QCD, hadron scattering

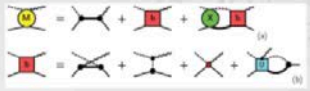
Medium energy: radiative corrections, coupled channels, hadron resonances,...

Low energy: reliable uncertainties from few-nucleon Chiral Effective Field Theory



- *Compton scattering/hadron polarizabilities:* lattice, low-energy theory, experiment under one roof
- Limits of the Standard Model. Simplicity in complex systems
- Work with GW experiments: Jefferson Lab, HIγS, MAMI,...





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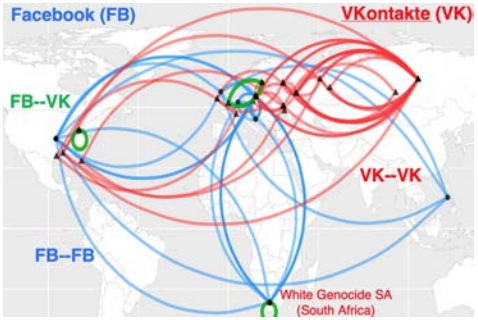
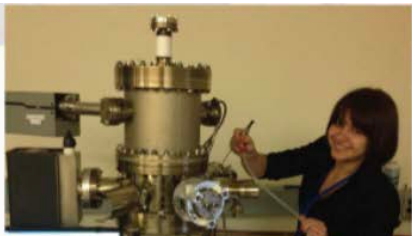
Our Program: New Research Areas – Quantum Optics, Complex Systems, Machine-Learning

- Photonics, 'many-body' non-equilibrium systems, evolution and information spreading, learning from bid/complex data using AI methods
- Faculty: Andrei Afanasev, Neil Johnson, Oleg Kargaltsev
- Students: 5-6 PhD students and MS students



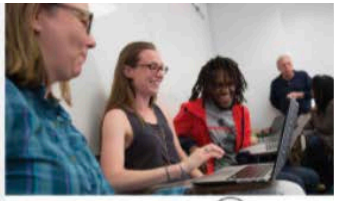
Research high-efficiency solar cells

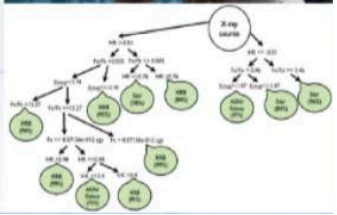
- Nanostructures & photocathodes
- Quantum optics & twisted photons

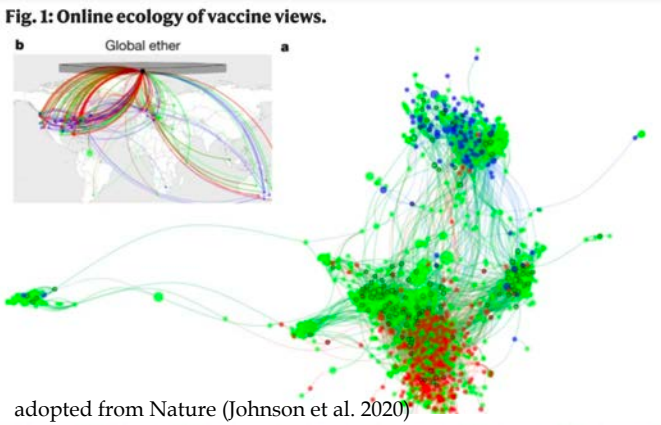


Certificate in Data Science and High-Performance Computing

- Applied Statistics
- Big Data
- Machine-Learning







adopted from Nature (Johnson et al. 2020)

Admissions: FAQ

How do I make my application stand out? Excellent grades in Physics and Math courses, previous research experience, programming experience and/or use of computer for data analysis.

Do I need to specify research area in my application? No. You have the freedom to select or change research are while in our program. However, if you have prior research experience in a particular area or have strong preference for PhD research are please indicate it.

Should I receive a master's degree before applying to your PhD program? No.

How heavily weighted are the parts of the application: GRE and other test scores, GPA, and extracurriculars?

GPA in Phys and Math courses matters a lot, your motivation (don't use standard language or copy/paste from online resources when writing your essay), prior research experience, and recommendation letters.

We *do not require GRE Physics*, GRE General is required (by CCAS) but does not have a large weight when compared to other components. If your GPA in Physics/Math is not great then listing a good GRE Physics score may help (but again, it is not required).

Admissions: FAQ (continued)

What are some of the things that should be avoided in a graduate school application?

Do not state research interest is in a very narrow subject unless you are 100% sure this is the only thing you would like to do ever. If unsure, better mention few areas that may be of interest to you or express interest in a broader area.

Look carefully at the Physics Department website before applying. It is a common mistake when the applicant expresses interest in an area which does not match research area of any faculty Spend some time looking at the research done by faculty and see if your interests overlap with t hose of any GW Physics faculty.

Do not send a generic statement of purpose. Give it a thought and then write it by yourself. Think of why are you applying to GW not some other place. Your essay should not be much longer than 1 page.

Talk to your referees and make sure they write personalized (not generic) letter about you.

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