

**ALLIANCE RESEARCH
INTERNSHIP PROGRAM
AT COLUMBIA UNIVERSITY
ACADEMIC YEAR 2022-2023**

***DEADLINE TO APPLY:
NOVEMBER 30, 2022***

Created in 2002, the [Alliance Program](#) is an innovative joint venture between Columbia University, the École Polytechnique, Sciences Po, and Paris 1 Panthéon-Sorbonne University. Every year, Columbia University offers several student internships in scientific disciplines open to École Polytechnique students. The process for applying to these internships is outlined below.

I. Internship Description

- Students work with a faculty member, who acts as an academic advisor and supervises their research project.
Internships will start in March/April 2022. The duration, objectives and tasks of the internship will be discussed with the supervisor at the host center or department.
- Internships are not paid. *If a stipend is offered, it will be specified in the internship offer.*
- Students are responsible for finding housing.
- *All students are required to apply for a J1 Visa to conduct an internship in the United States.*

II. Applications requirements

- Applicants must include: a CV, a cover letter (1 page), and a letter of recommendation.
- **Students must send their application to the Alliance Program: alliance@columbia.edu**
- All materials must be submitted in English.

DEADLINE – November 30, 2022
All applications must be sent to alliance@columbia.edu

DEPARTMENT OF PHYSICS

1. Faculty Sponsor:

Szabolcs Márka,
Walter O. LeCroy Jr. Professor of Physics
Columbia Astrophysics Laboratory, 1009 Pupin Physics Laboratories

2. Number of interns:

One (1) to three (3)

3. Type of support available:

- ✓ Access to campus services and facilities
- ✓ Immigration and visa assistance/sponsor

4. Internship Title:

Emerging Computing from AI to Quantum to Discover Cosmic Gravitational-waves

5. Description:

The students will invent, develop and deploy innovative techniques relying on machine learning and quantum computing to open new and efficient windows in the searches for cosmic gravitational-waves in the multimessenger context. Advanced computer engineering methods, statistics, and astrophysics will be learned, used, and advanced. Strong curiosity, ability to deal with the unknown, and creative thinking are expected.

6. Skills:

We are seeking motivated individuals who can create new ideas and able to follow them to the proper finish line, publication. Strong programming and statistics background is advantageous, including Python, C, and Quiskit.

7. Additional Information:

Teamwork is the standard in our community, thus there is an opportunity to hone both leadership and team-working skills. We are only interested in pioneering hard and impactful problems, where few has any experience. We can only offer rewarding challenge and tough problems to solve.

IRVING INSTITUTE FOR CANCER DYNAMICS (IICD)

1. Faculty Sponsor:

Elham Azizi, Assistant Professor of Biomedical Engineering and Herbert and Florence Irving Assistant Professor of Cancer Data Research (in the Herbert and Florence Institute for Cancer Dynamics and in the Herbert Irving Comprehensive Cancer Center)

2. Number of interns:

One (1) to two (2)

3. Type of support available:

- ✓ Stipend
- ✓ Access to campus services and facilities
- ✓ Immigration and visa assistance/sponsor

4. Internship Title:

Deep generative models for analysis of high-dimensional genomic and imaging data

5. Description:

We have multiple research projects involving the development of novel machine learning techniques for characterizing the dynamics of diverse cell types within cancer tumors towards understanding cancer progression and response to treatments. One project models temporal dynamics and interactions between cells during response to immunotherapies using graph convolutional networks with variational inference. Another project focuses on developing a variational autoencoder to integrate genomic and imaging data.

6. Skills:

Background in statistics, computer science, or bioengineering; and strong programming skills in Python.

7. Additional Information:

Please visit our lab website www.azizilab.com for further information about our research.

IRVING INSTITUTE FOR CANCER DYNAMICS (IICD)

1. Faculty Sponsor:

Professor Simon Tavaré (Director, Irving Institute for Cancer Dynamics [IICD]; Professor of Statistics and of Biological Sciences)

2. Number of interns:

Up to two (2)

3. Type of support available:

Stipend
Access to campus services and facilities
Immigration and visa assistance/sponsor

4. Internship Title:

Irving Institute for Cancer Dynamics Internship

5. Description:

The Irving Institute for Cancer Dynamics has opportunities for internships for students with interests in the mathematical sciences and their applications in cancer research. We have opportunities in areas such as analysis of single-cell DNA sequencing data, stochastic models of tumor growth, mathematical immunology, geometric and topological data analysis, mathematical population genetics, and phylogenetics. Internships can be crafted to suit the applicant.

6. Skills:

Background in mathematics, statistics, computer science or biological sciences with a strong quantitative component. Prior experience in cancer research would be useful but is not required.

7. Additional Information:

The IICD is an interdisciplinary institute located on the Morningside Heights campus of Columbia University and focused on the interplay between the mathematical sciences and cancer research, collaborating across disciplinary boundaries to develop tools and methods that can improve our understanding of cancer biology, origins, treatment and prevention. Our website, at cancerdynamics.columbia.edu, gives an overview of our research teams and our current projects.

MORTIMER B. ZUCKERMAN MIND BRAIN BEHAVIOR INSTITUTE

1. Faculty Sponsor:

Rudy Behnia, Assistant Professor of Neuroscience
<http://behnialab.neuroscience.columbia.edu/>

2. Number of interns:

One (1) to two (2)

3. Type of support available:

- ✓ Stipend
- ✓ Access to campus services and facilities
- ✓ Immigration and visa assistance/sponsor
- ✓ Will assist in finding accommodation

4. Internship Title:

Investigating color circuits in behaving *Drosophila melanogaster*

5. Description:

How are colors encoded in the brain? Despite decades of research, this question remains unanswered. My lab is interested in deciphering the neural computations underlying color vision by exploiting the genetic toolkit of *Drosophila* to ask how spectral information from photoreceptors in the eye is combined to encode colors in the brain. We use electrophysiological recordings, 2-photon activity imaging in live animals in response to visual stimuli as well and behavioral assays to characterize the role of specific neurons in color encoding. The intern will be involved in the process of setting up an advanced visual stimulus system for color vision to be used in combination with imaging methods and behavioral assays and performing experiments to understand how color signals drive behavior.

6. Skills:

Coding (Python) and quantitative methods, optical/mechanical/electrical engineering background encouraged but not necessary. Self-motivated, ability to work independently but also collaboratively.

7. Additional Information:

For those interested in computational/theoretical neuroscience, we have a close collaboration with the Center for Theoretical Neuroscience at Columbia University.

**CENTER FOR INTERNATIONAL EARTH SCIENCE INFORMATION NETWORK
(CIESIN) - COLUMBIA CLIMATE SCHOOL****1. Faculty Sponsor:**

Mr. Xiaoshi Xing, Information Scientist, CIESIN, Columbia Climate School, Columbia University, New York, USA

2. Number of interns:

Two (2)

3. Type of support available:

- ✓ Access to campus services and facilities – Yes, on Columbia Lamont Campus (with hourly campus shuttles from/to Manhattan campus).
- ✓ Immigration and visa assistance/sponsor

4. Internship Title:

- a) Climate Change Observed Impacts /Adaptation
- b) Comparative studies on air quality exposure disparities among U.S. and French (or another EU country) populations.

5. Description:

- a) Working with scientist/researcher/data expert at the Intergovernmental Panel on Climate Change (IPCC) Data Distribution Center (DDC) at CIESIN, on construction of an integrated database on climate change observed impacts /adaptation and perform related analysis.
- b) Working with scientist/researcher at CIESIN/NASA SEDAC, in collaboration with those at Harvard School of Public Health, on development of air quality data (PM2.5, O3, NO2) on various levels of geographies in the U.S. (almost complete) and France (or another EU country), and on the integration with the demographic/socioeconomic variables for comparative studies on the exposure disparities among populations in two countries. Produce time series maps for visualization.

6. Skills:

- a) Good MS Excel skills and strong English literature review, summary/writing skills required. Basic Some programming skills in VBA/Python/R preferable. GIS/mapping knowledge helpful (ArcGIS training can be provided).
- b) Data science driven project. Strong programming skills in R/Python required. Visualization /GIS/Mapping knowledge helpful (ArcGIS training can be provided).