Chair's Colloquium: State of the Department

Dept. of Physics and Astronomy, August 27, 2024





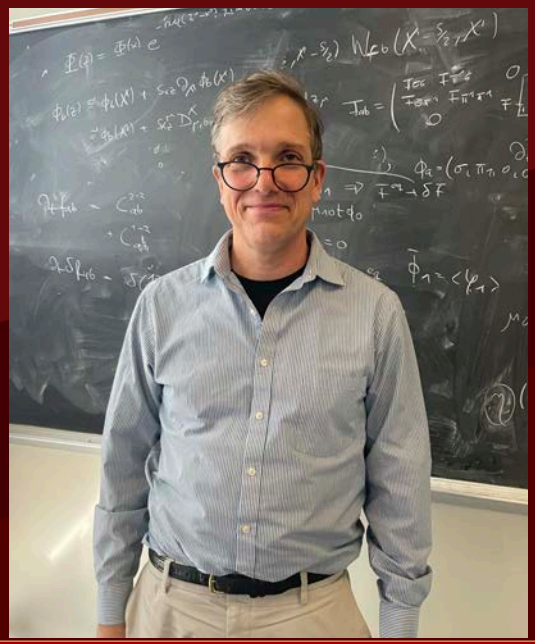

Department Main Office

- Chair: Chang Kee Jung
- Department Administrator/Chief of Staff: Nathan Leoce-Schappin

- Graduate Program
  - ¬ Director: Matt Dawber
  - ¬ Incoming Director: Derek Teaney
    - To start in January 2025
  - ¬ Assistant Director: Donald Sheehan

Rosalba Perna
Associate Chair, 2021-2024
Thank you!

Matt Dawber
Current GPD
2019 - 2024



Derek Teaney
Incoming GPD
2025 -

Department Main Office

- Undergraduate Program
  - ¬Director: Dominik Schneble
  - ¬Assistant Director: Diane Diaferia
- Lead Business Officer/Grant Manager: Jin Bentley
- Grant Manager: Kacey Jashfar
  - ¬Started in April 2024 → Welcome on board!

Kacey Jashfar
Grant Manager

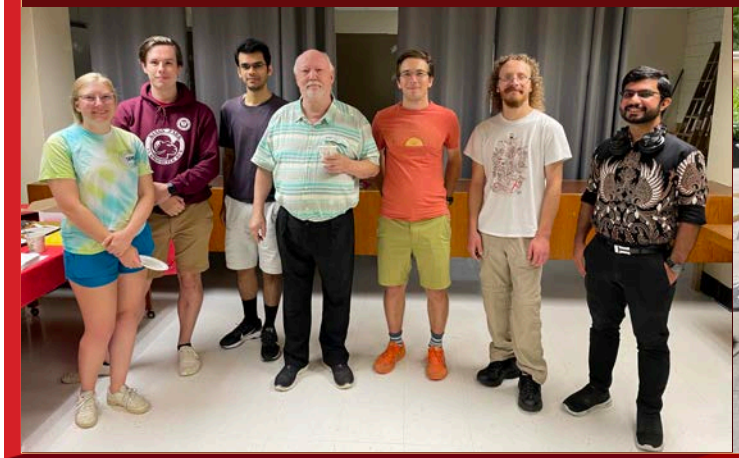
- Director of Laboratories: Frank Chin
- Building Manager: Richard Berscak

Technical Support Labs and Shops

- Instructional Labs
  - ¬Manager: Bent Nielson
    - Retired in July 2024 after 23 years of service
      - ➢ See next slide
    - On-going search for his replacement
  - ¬Manager, Senior Labs: Kanishka Wijesekara

- Machine and Electronics Shops
  - ¬Manager: James Eksi
  - ¬Equipment Designers: Paul DiMatteo, Jeff Thomas
  - ¬Technical Staff: Jason Visentin
  - ¬Electronics Engineer: Vaneet Singh
  - ¬On going search for a machinist

Bent Nielsen Retirement



Chair's Colloquium, Aug. 27, 2024 Chang Kee Jung Dept. of Physics and Astronomy Stony Brook University

In addition, we have many outstanding support staff for each research group, institute and center.

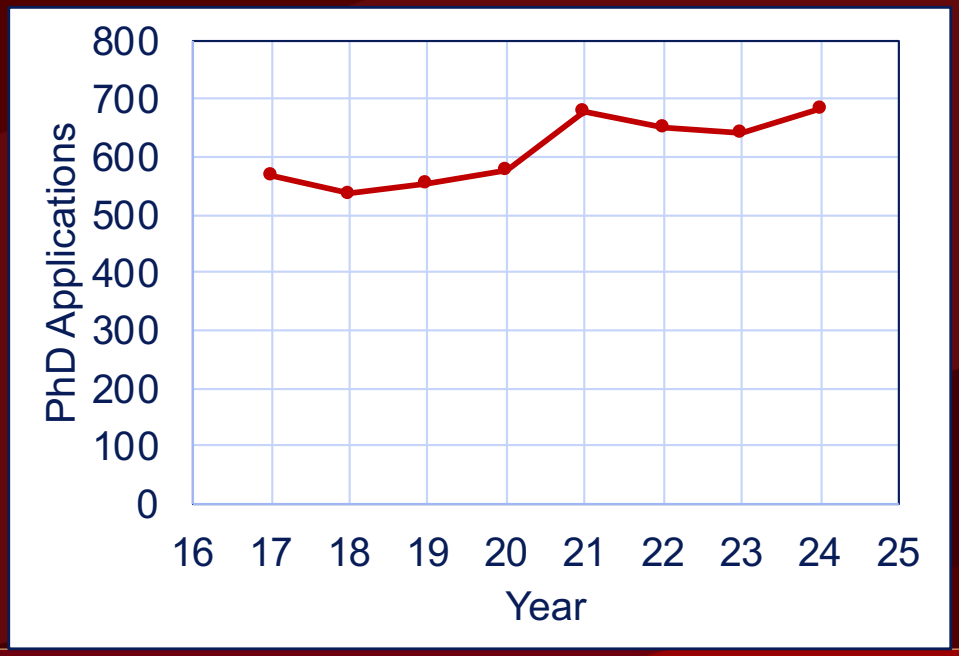
Let's thank all who served the department with their dedication and welcome all new faculty and staff on various service positions

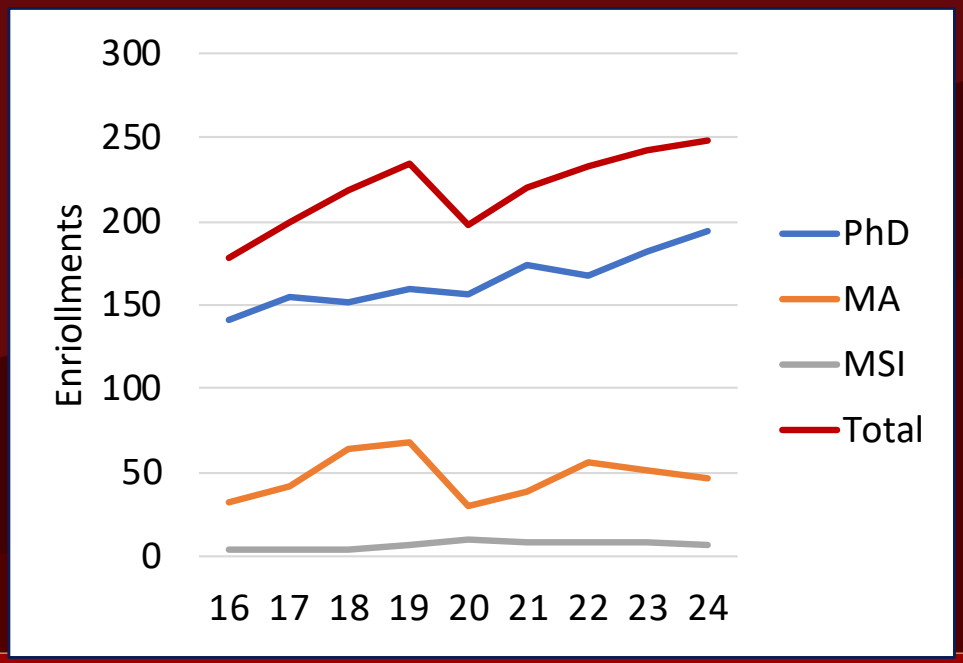
Graduate Program: Incoming Graduate Students Class 2024

- Fall 2024
  - 29 PhD, 14 MA, 2 MSI, 1 MSQIST
  - 26 Domestic, 20 International
  - 34 Male, 7 Female, 5 Non-Binary

- 2024 Nationalities
  - USA(25), China (5), India(4), Mexico (2), Brazil, Canada, Chile, Egypt, Hong Kong, South Korea, Spain, Taiwan

→ From 13 countries in 5 continents





Graduate Program: New PhD Students 2024

Dathan Ault-McCoy	Stony Brook (MA)	US
Rodrigo Cadiz Carvajal	Pontifica Universidad Catolica de Chile	Chile
Jiaxi Cao	Reed College	China
Leonardo Castillo Veneros	Stony Brook (MSI)	US
Chi-Chih Chen	Stony Brook (MSI)	Taiwan
Emily Finson	Rochester Institute of Technology	US
Alex Heindel	South Dakota School of Mines	US
Ivy Huang	Wesleyan University	US
Mahmoud Amr Elsayed Ali Ibrahim	Stony Brook	US
Edward Keenan	Johns Hopkins University	US
Maxence Larose	University of Oxford (UK)	Canada
Gannon Lawley	Stony Brook (MA)	US
Amanda Lee	U Mass Amherst (PhD)	US
Ziyi Lin	Stony Brook (MA)	US
Joshua Martin	Stony Brook (MA)	US
Luke Martin	Northeastern University	US
Jake Montgomery	Old Dominion University	US
Gustavo Stuart Orozco Galvan	University of Arkansas	Mexico
Ji Hoon Park	Stony Brook (MSI)	South Korea
Angel Ploneda Preciado	Universidad de Colima	Mexico
Nathan Shankman	Stony Brook (MA)	US
Paras Sharma	Stony Brook (MA)	India
Pushaba Shome	IIT Dhanbad	India
Abigail Swanson	University of Mary Washington	US
Gloria Tejedor Garcia	Old Dominion University	Spain
Jonathan Tekverk	Stony Brook (MA)	US
Alessandro Tripoli	Stony Brook (MA)	US
Heng Wang	Stony Brook/Anhui (UG)	China
Shangke Zhou	Stony Brook (MA)	China

Graduate Program: New Masters Students 2024

Aditya Agarwal	UC Davis	India
Sivadarshan Aravindan	U of Oklahoma	US
Bela Arwen	Vassar College	US
Andrew Binder	UC Berkeley	US
Xavier Braun	U Conn	US
Yuze Chen	U Wisconsin-Madison	China
Abishek Cherarth	Stony Brook (UG)	India (PR)
Carrie Cox	Seattle Pacific U	US
Ian Johnson	Caltech	US
Nirvesh Joshi	IIT Delhi	India
Zhiquan Lao	U Michigan	China
Zhanyu Lu	Annhui/Stony Brook	China
Natalia Raymundi Pinheiro	UIUC	Brazil
Ian Segal-Gould	UConn	US
Graham Speedie	U Mississippi	US
Ishan Varma	Pomona College	US

Let's welcome 2024 incoming graduate students!

Graduate Program: Graduates in 2023/2024

- Fall 2023/Spring 2024/Summer 2024
  - ¬PhD: **18**
  - ¬MSI: **4**
  - ¬MA: **22**
  - ¬MSQIST: **1**

Graduate School Award Winners

- **Yichul Choi** working with Shu-Heng Shao and Zohar Komargodski was one of the winners of the **President's Award to Distinguished Doctoral Students** for his work on *Generalized Symmetries in Quantum Field Theory and Particle Physics*

- **Waltraut Knop** working with Leonardo Rastelli was the winner of the **John Marburger III Fellowship for Science, Engineering and Mathematics** for her work exploring theories of Quantum Gravity.

Catherine Feldman Wins First Place in 2024 3MT Competition!

P&A Past 3MT Laureates:

- Derek Pope (advised by Angela Kelly) in 2022,
- Sonali Gera (advised by Eden Figueroa) in 2020,
- Zoya Vallari (advised by Chang Kee Jung) in 2017

"I loved the practice sessions and really looked forward to sharing each new draft because I knew that it would be even better afterwards. For me, 3MT turned into a larger challenge of explaining why basic science research is so important." – Catherine Feldman

Ben Levine Wins a CELT Teaching Award!

Master of Arts in Teaching (MAT) Program

- Prepares students with a BA degree in a physical science or engineering for the NY state certification as a secondary school teacher
- Program Advisor: Bob McCarthy → Angela Kelly
- Major contribution to the department receiving 2022-2023 "5+Club" Award for physics teacher education
  - ¬ The Department has received this recognition 7 out of the past 9 years

Physics Teacher Education Coalition AAPT PHYSICS EDUCATION APS physics

→ **The Chair's challenge:**

Let's make this to "10+Club"!

PhysTEC

Physics Teacher Education Coalition

The 5+ Club

Recognizes institutions that graduate 5+ physics teachers in a given year

2022-2023 Awardees

California Polytechnic State University, San Luis Obispo
5 graduates

California State Polytechnic University, Pomona
6 graduates

California State University, Long Beach
11 graduates

Colorado School of Mines
5 graduates

Brigham Young University - Idaho
15 graduates

Illinois State University
8 graduates

Lewis University
5 graduates

Bridgewater State University
8 graduates

University of Minnesota Twin Cities
5 graduates

Rutgers University - New Brunswick
5 graduates

The College of New Jersey
6 graduates

New Jersey Center for Teachi Learning
13 graduates

SUNY Geneseo
5 graduates

SUNY Stony Brook
9 graduates

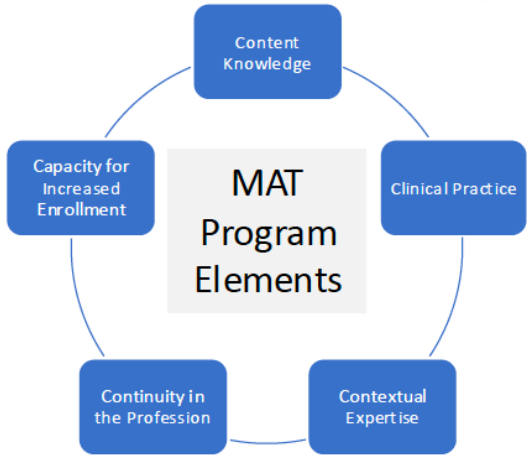
University of Texas - Austin
5 graduates

Brigham Young University
7 graduates

Western Governors University - Utah (Main)
16 graduates

University of Wyoming
5 graduates

13 institutions graduated 5+ new teachers in the 2022-2023 AY, and 5 non-doctoral institutions graduated 5+ new teachers over the 2020-2023 AYs.

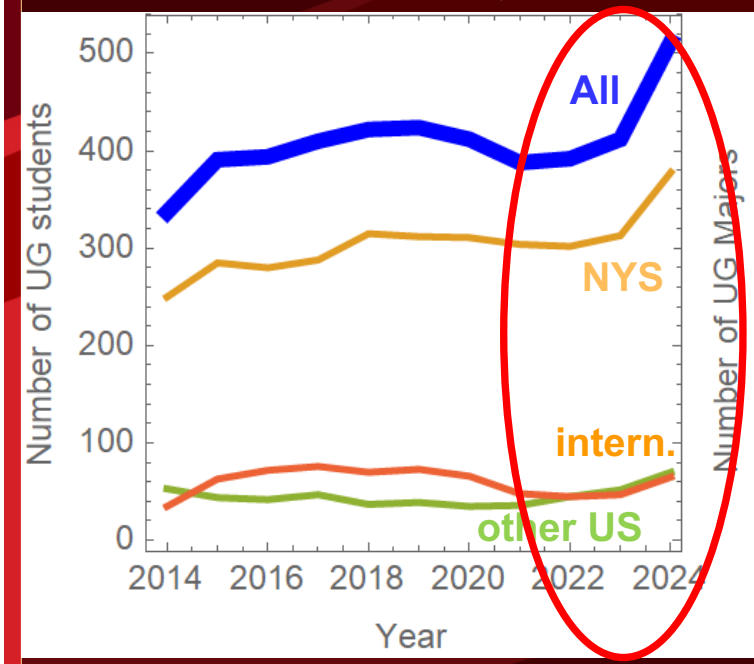


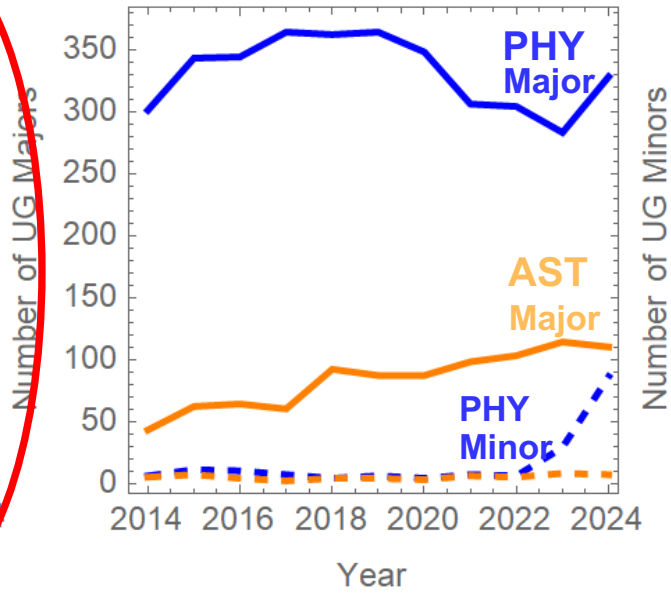
This is the historic record for the Dept MAT program and very close to the Chair's challenge: "10+Club"!

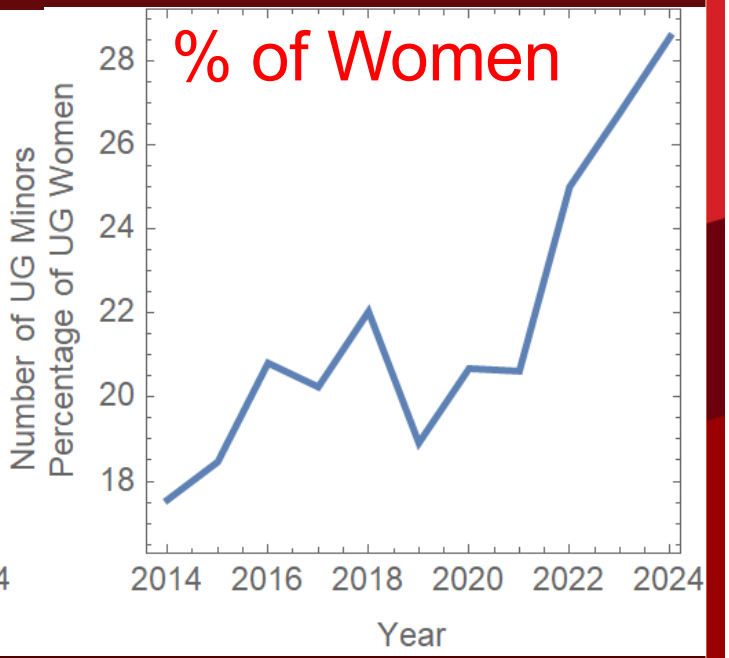
1. Karen Calabrese
2. Joseph Cavalieri
3. Jameson Coleman
4. Kenneth Cortes
5. Onnolee Englert-Erickson
6. Katlyn LaFranca
7. Joseph Monroy
8. John Pedersen
9. Daniel Trieu

Undergraduate Programs in PHY and in AST

- Fall 2024 Student Body
  - ¬ 511 students (74% NYS, 13% other US, 13% international)
  - ¬ 328 PHY majors, 110 AST majors (incl. 22 double majors)
  - ¬ 86 PHY minors, 7 AST minors
- Fall 2024 Diversity
  - ¬ Domestic: White 35%, Asian 35%, Hispanic/Latino 17%, African American 4%, Other 9%.
  - ¬ 28% female (up from 18% in F14)







47 PHY and 8 AST bachelor's degrees awarded in 2023/24

Stony Brook Institute at Anhui University (SBIAHU)

- 2023 Arrival Students (6)
  - Xianglei Fang
  - Weibo Sun
  - Mia Zheng
  - Runchen Li
  - Shukun Li
  - Junlan Xu
- 2024 Arrival Students (14)
  - Shengze Wang
  - Zizheng Wang
  - Chenye Yuan
  - Mingyang Fan
- 2024 Arrival Students
  - Simon Xia
  - Wenlin Chen
  - Yunfan Hu
  - Sijia Li
  - Can Xu
  - Jiakang Xu
  - Chengye Yin
  - Zehao Li
  - Jingxiao Wang
  - Yongxin Wang

Nominally the first 3 years at Anhui and last 1 year at Stony Brook → Welcome to Stony Brook!

The 2nd Undergrad Research Day

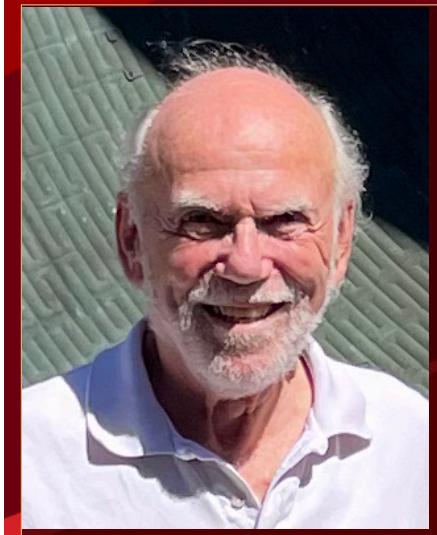
- Friday, March 22, 2024 in S-240
  - ¬9:30 – 10:00 am: Breakfast
  - ¬10:00 – 12:00 pm: 4 invited faculty talks
  - ¬12:00 – 12:30 pm: Lunch
  - ¬12:30 – 2:00 pm: Research Fair
  - ¬2:00 – 5:00 pm: Undergrad research poster presentations
    - Judged by a faculty panel (invited)

→Organized by the SPS and the NSBP-SBU (done an excellent job!)

2nd Undergraduate Research Day
Research Fair

Based on the success and popularity of the Research Fair, SPS is planning to hold another Research Fair, tentatively, on **Friday, November 8th**

2nd Undergraduate Research Day
Poster Presentations: Honorable Faculty Judges



Barry Barish

Jan Bernauer

Raymond Blackwell

Mike Zingale

2nd Undergraduate Research Day
Poster Presentations

"This is remarkable. We don't have this in Caltech!" -- Barry Barish

2nd Undergrad Colloquium Speakers (selected from the poster presentations)

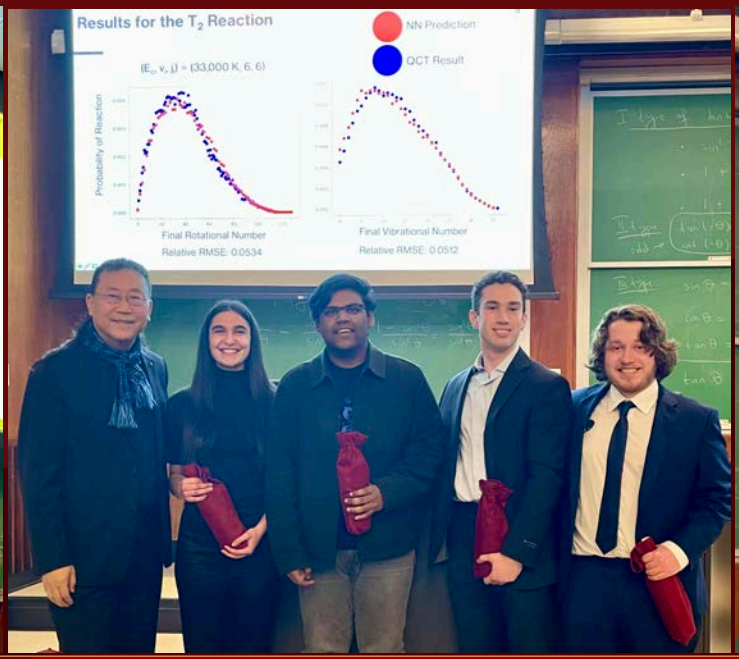
Charles Brown

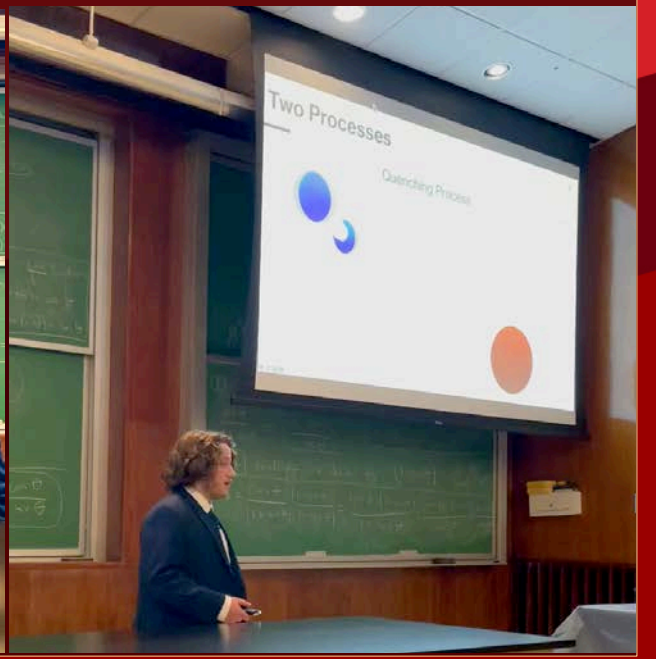
Daniel Julian

Donna Mahalli

Sudat Khan

2nd Undergrad Colloquium





Chair's Colloquium, Aug. 27, 2024 Chang Kee Jung Dept. of Physics and Astronomy Stony Brook University

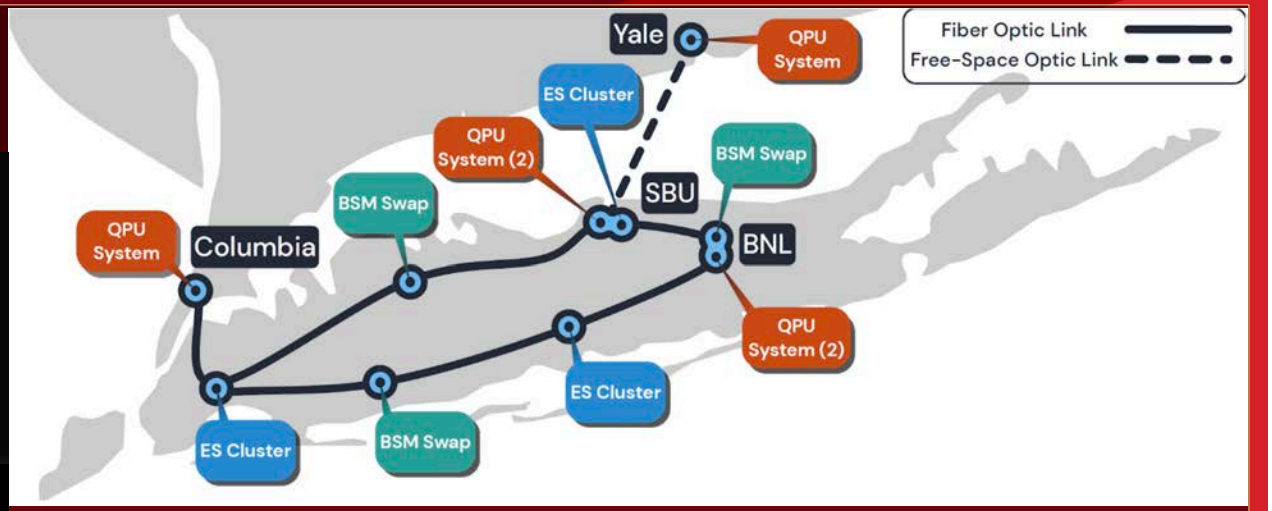
Stony Brook SPS Wins National Recognition for Second Consecutive Year!

- The National Council of Society of Physics Students (SPS) has reviewed all chapter reports and has awarded the Stony Brook University **SPS** Chapter as a **2022-23 Outstanding Chapter** continuing the streak started with last year's recognition for their same outstanding efforts!

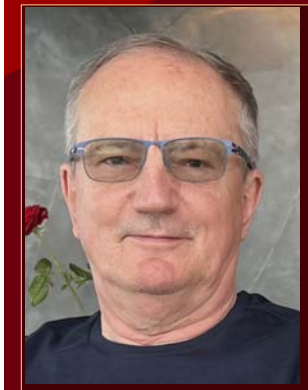
Program Highlight: Quantum Information Science & Technology (QIST)

QIST Project Led by Stony Brook Selected for a NQVL Pilot Project

The SCY-QNet (Wide-Area Quantum Network To Demonstrate Quantum Advantage) proposal led by our own Eden Figueroa has been selected by NSF as one of the five pilot projects for the NSF National Quantum Virtual Laboratory (NQVL).

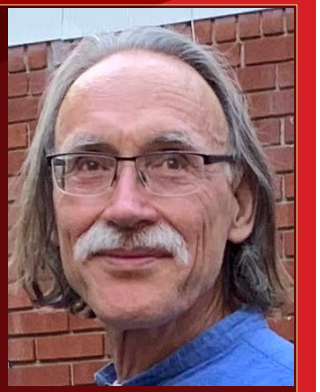


Faculty Promotions



Laszlo Mihaly

Professor to SUNY Distinguished Service Professor



Jac Verbaarschot

Professor to SUNY Distinguished Professor

Xu Du

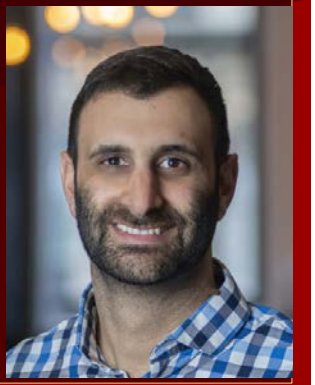
Associate Professor to Full Professor

Giacinto Piacquadio

Associate Professor to Full Professor

Jan Bernauer

Assistant Professor to Associate Professor



Cyrus Dreyer

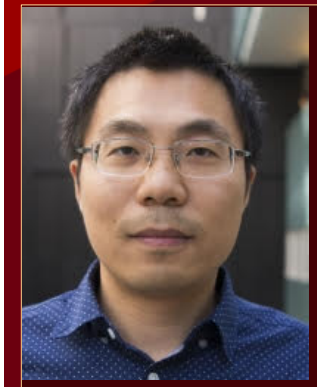
Assistant Professor to Associate Professor

University Investitures Ceremony
(November 2023)

Eden Figueroa
Presidential Innovation
Endowed Professor

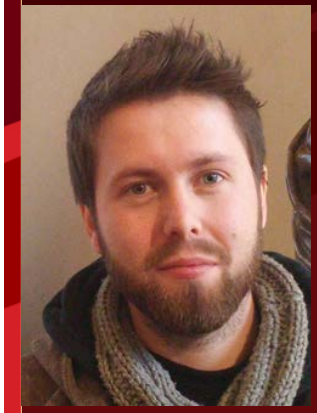
Leonardo Rastelli
Renaissance Endowed Chair of
Theoretical Physics

New Faculty Recruits



Yin-Chen He
Assistant Professor
Formal Theory
YITP (Jan. 2025)

Han Ma
Assistant Professor
Condensed Matter Theory
(Jan 2025)



Ciro Riccio
Assistant Professor
HEP/NN (Neutrino)

Felix Ringer
Assistant Professor
Nuclear Theory

Nathanan (Nat) Tantivasadakarn
Assistant Professor
QIST Theory
YITP (Sep. 2025)

All searches in AY23-24 have resulted in the first choice candidates committing to our department!

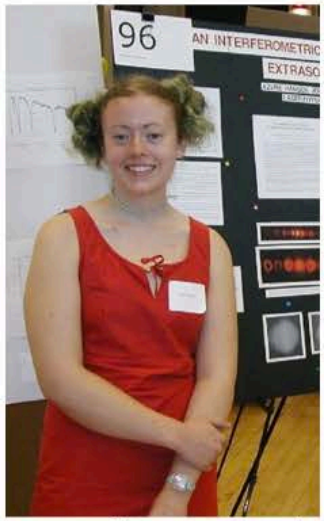
Notable Events

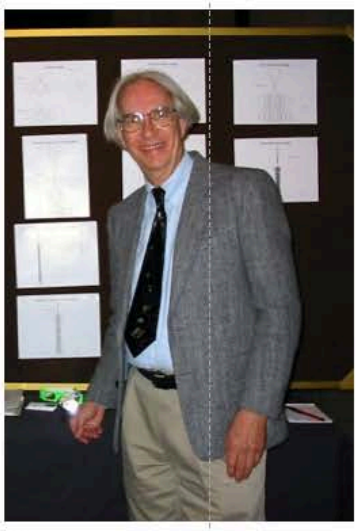
Laser Teaching Center

CELEBRATING 25 YEARS

1998-2023

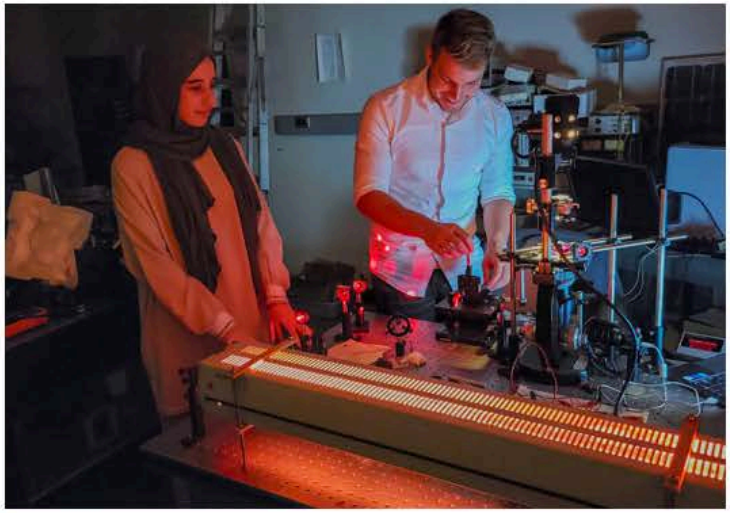
Monday Sep. 18, 2023

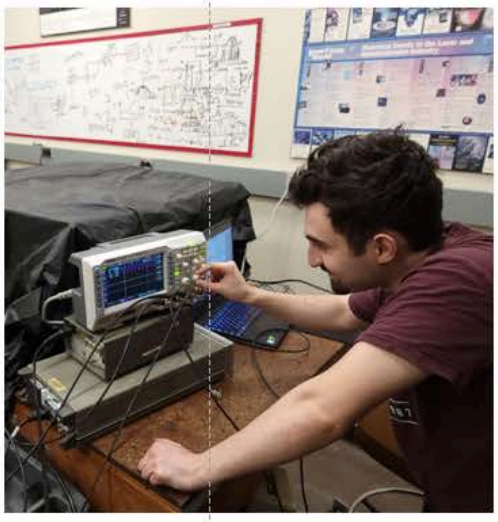




Our earliest members

2023 group





"This has been some of the best 7-weeks of my life. […] Words honestly can not begin to describe how grateful I am for everything, from being given this opportunity to your support and encouragement."
-**Angelika Wang**, SSRP '23

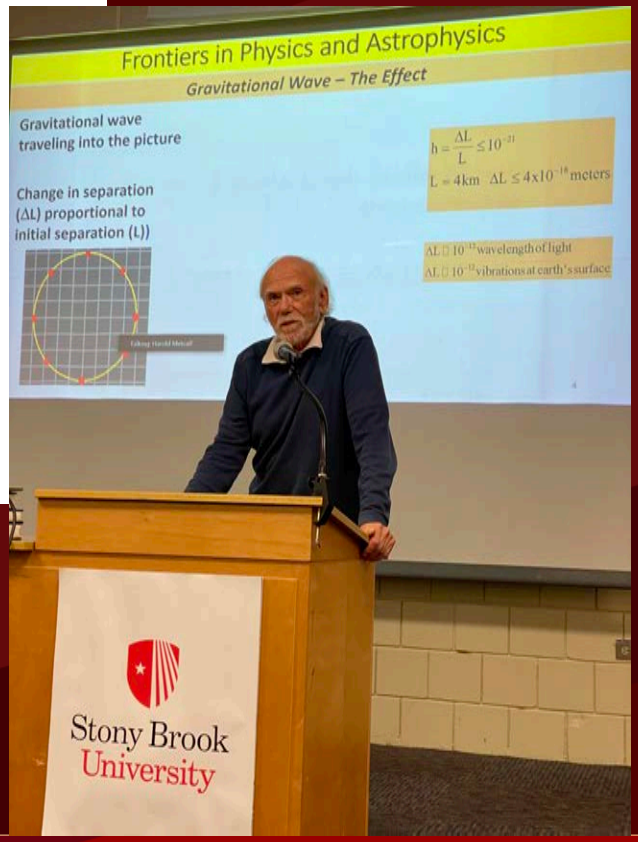
The 25th Anniversary of the Laser Teaching Center

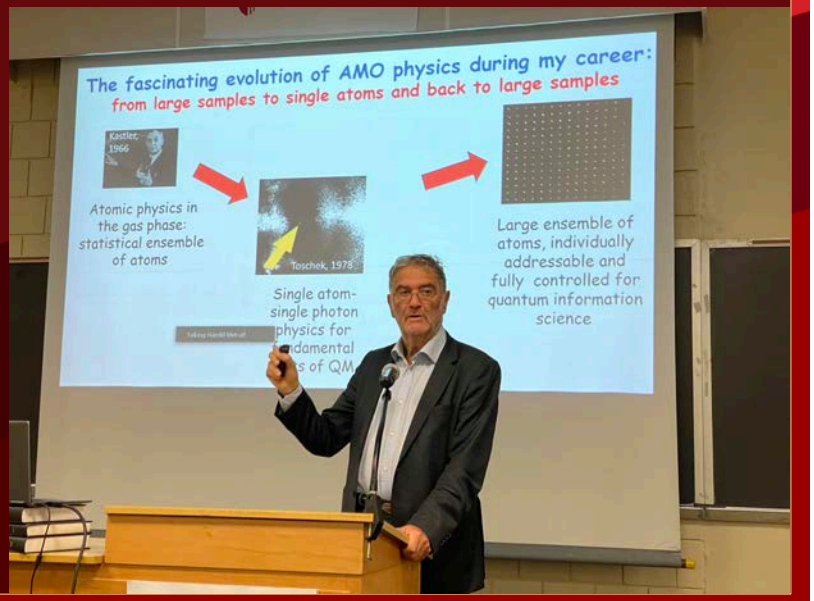
Laser Teaching Center

25

YEARS 1998-2023

18 September 2023
Room S-240, Physics,
Stony Brook University





Abhay Deshpande Named BNL Interim Associate Lab Director for Nuclear and Particle Physics

Abhay Deshpande, SUNY Distinguished Professor, has held many leadership roles. He is the Director of the Center for Frontiers in Nuclear Science (CFNS) and the Director of Science for the Electron Ion Collider (EIC) at BNL

Remembering Jim Simons

Beloved friend, generous philanthropist, pioneering mathematician, and visionary leader James H. Simons died on May 10 at the age of 86.

Prof. Barry Barish, Nobel Laureate 2017 started teaching an undergrad course at Stony Brook

- The Inaugural President's Distinguished Endowed Chair in Physics
- Teaches a grad course: PHY560 "Frontiers of Physics and Astrophysics"
- In addition, started teaching an undergrad course: PHY390 voluntarily this semester
- Resident in Stony Brook/NYC area for each fall semester

The 3rd C.N. Yang Colloquium
September 17, 2024

- New annual distinguished colloquium series in honor of Frank C.N. Yang
- Co-hosted by YITP, SCGP and P&A
- The 3rd Colloquium by David Gross, Nobel Laureate 2004

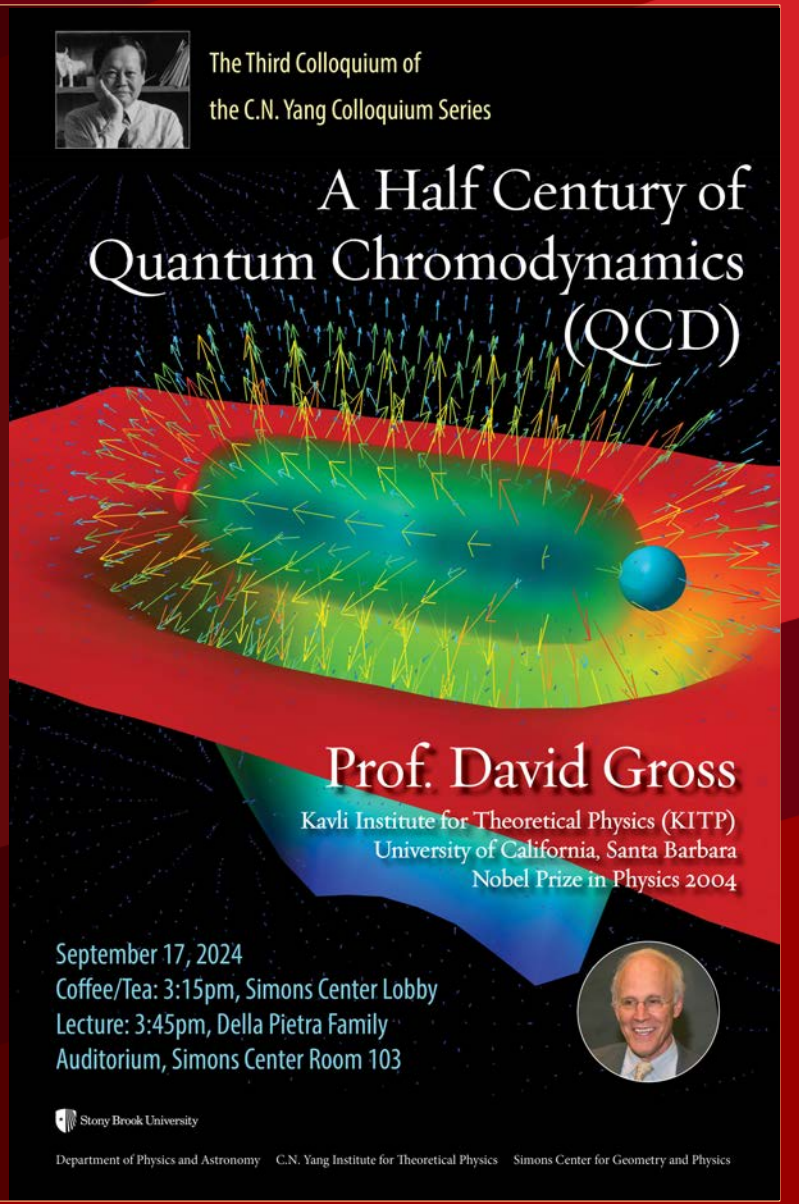
Title: Fifty Years of Quantum Chromodynamics

(The Theory of the Strong Nuclear Force)

Abstract: I shall discuss the past, present and future of this remarkable theory

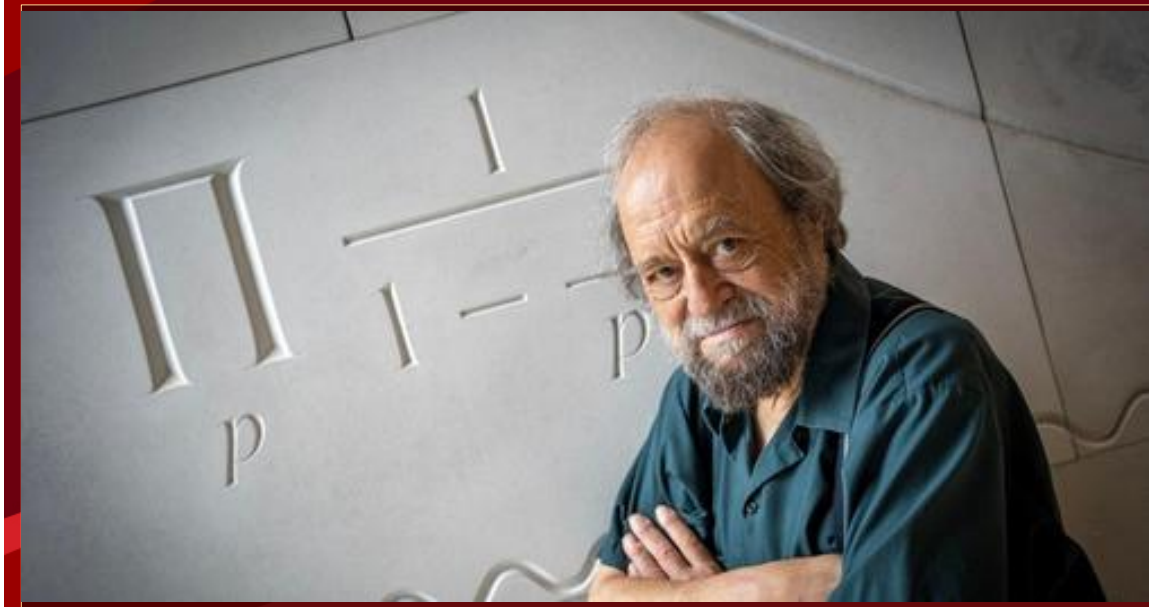
The 4th C.N. Yang Colloquium by Didier Queloz, Nobel Laureate 2019

"He is one of the originators of the "exoplanet revolution" in astrophysics. In 1995, as part of his PhD, he and his supervisor announced the first discovery of a giant planet orbiting another star, outside the solar system."



Faculty/Staff Honors:
Prizes, Awards and Significant Recognitions

Prof. Alexander (Sasha) Zamolodchikov shares 2024 Breakthrough Prize for Fundamental Physics



Prof. Zamolodchikov and co-winner, All Souls College, University of Oxford Professor John Cardy were cited

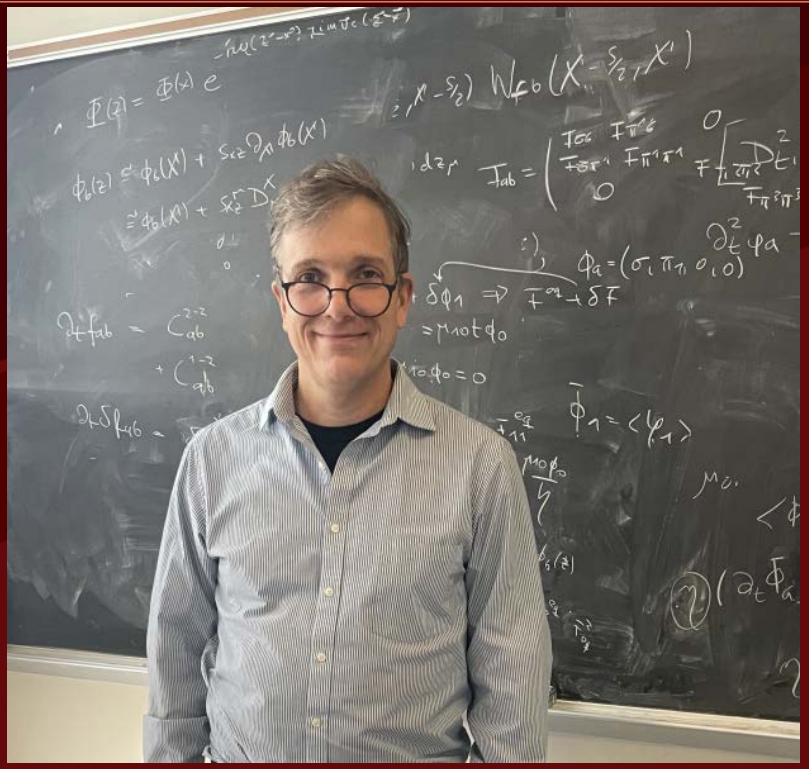
"*for profound contributions to statistical physics and quantum field theory, with diverse and far-reaching applications in different branches of physics and mathematics.*"

The 3rd Breakthrough Prize at SBU and the 5th with SB affiliation

Barry Barish Receives 2022 National Medal of Science (received in fall 2023)

for his "exemplary service to science, including groundbreaking research on sub-atomic particles." "His leadership of the Laser Interferometer Gravitational-Wave Observatory [LIGO] led to the first detection of gravitational waves from merging black holes, confirming a key part of Einstein's Theory of Relativity. He has broadened our understanding of the universe and our nation's sense of wonder and discovery."

2023 APS Fellow



Derek Teaney

Division of Nuclear Physics

"For pioneering work on the hydrodynamical description of the quark-gluon plasma created in relativistic heavy-ion collisions and for important advances in the non-equilibrium dynamics of quantum chromodynamics."

Emilio Mendez, elected Foreign Member of the Spanish Royal Academy of Science

REAL ACADEMIA DE CIENCIAS EXACTAS, FÍSICAS Y NATURALES DE ESPAÑA

Miembros de la Academia

INTRODUCCIÓN | GALERÍA DE PRESIDENTES | **ACADÉMICOS** | ACADÉMICOS HISTÓRICOS

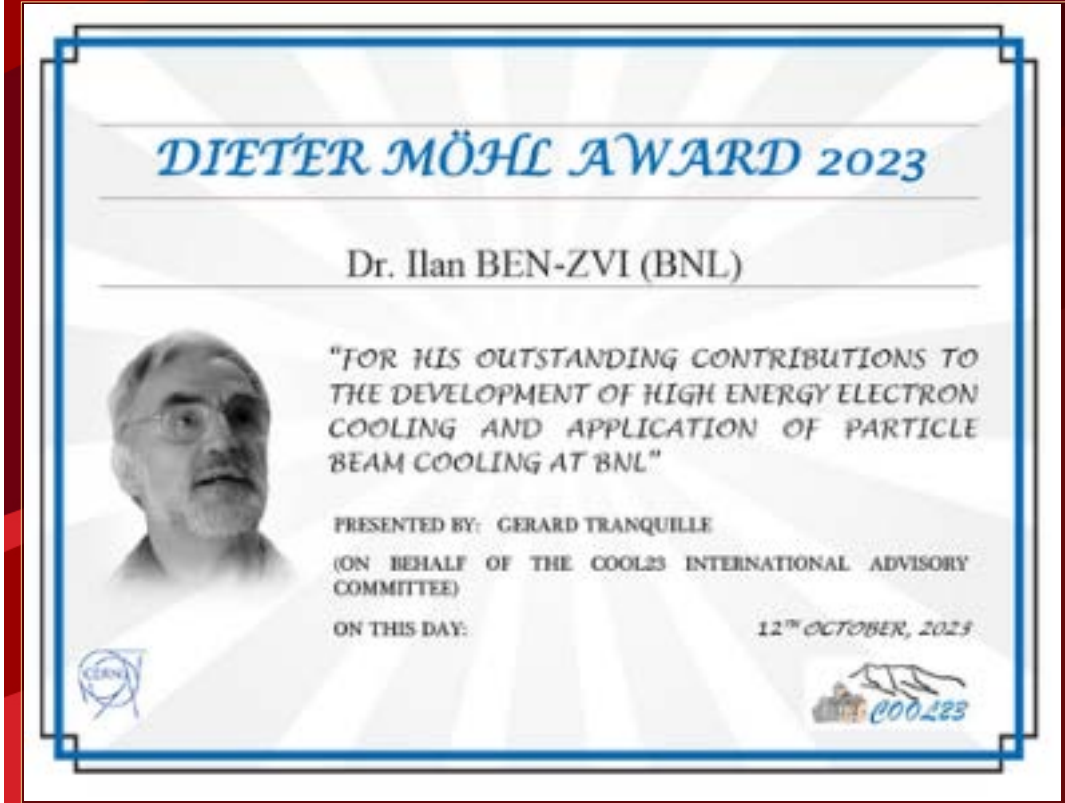
Extranjeros

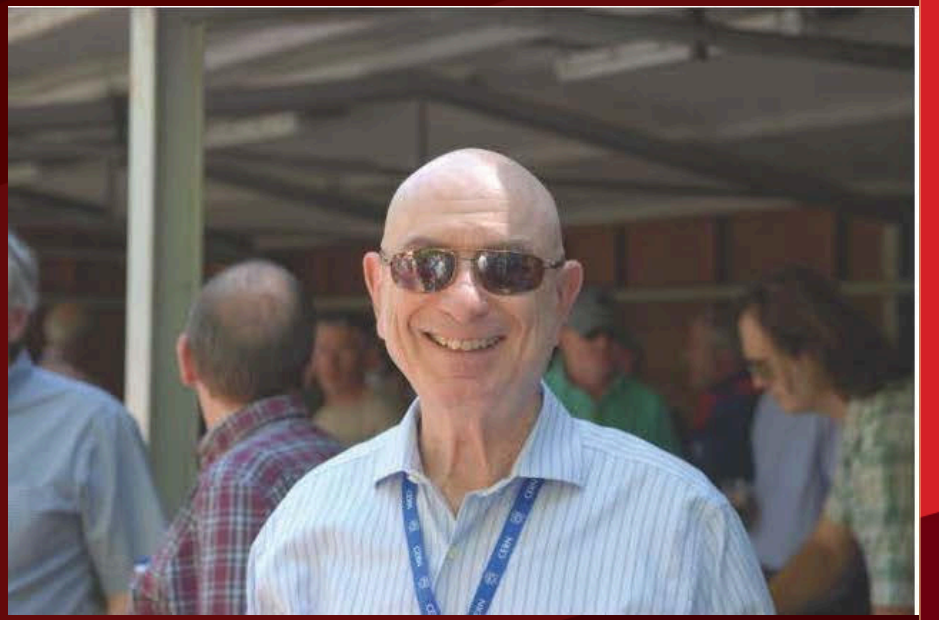
Sección: Físicas y Químicas

Prof. Chen Ning Yang	Prof. Henri Angelino	Prof. Armand Lattes	Prof. Stephen L. Buchwald
Prof. Yuri M. Davydov	Prof. C.N.R. Rao	Prof. Luis Felipe Rodríguez Jorge	Prof. Kenneth R. Poeppelmeier
Prof. Michael F. Ashby	Prof. Robert Dautray	Prof. Irina P. Beletskaya	Prof. Robert Huber
Prof. Samuel C.C. Ting	Prof. Ivan K. Schuller	Prof. Jean Marie Lehn	Prof. Ada Yonath
Prof. Michel Pouchard	Prof. Subra Suresh	Prof. Jean Pierre Sauvage	Prof. Majed Chergui
Prof. Brian P. Schmidt	Prof. Peter Zoller	Prof. Roald Hoffmann	Prof. Barry C. Barish
Prof. Reinhard Genzel	Prof. Richard R. Schrock	Prof. Rainer Blatt	Prof. Didier Queloz
Prof. Blas Cabrera	Prof. Paul A. Wender	Prof. Michel Mayor	Prof. M. Stanley Whittingham
		Prof. Enrique Iglesia	Prof. David W.C. MacMillan
		Prof. Jorge Peñarrubia	Prof. Maurizio Prato
		Prof. Xavier Barcons	Prof. Artur M.S. da Silva
		Prof. José Ignacio Latorre Sentís	Prof. Emilio E. Méndez

Congratulations to Emilio!

Adjunct Prof. Ilan Ben-Zvi wins the COOL23 Dieter Möhl Award





"For his outstanding contributions to the development of high energy electron cooling and application of particle beam cooling at BNL".

Ken Lanzetta selected as a Fulbright U.S. Scholar for 2024-2025 for Chile (Condor Atacama)

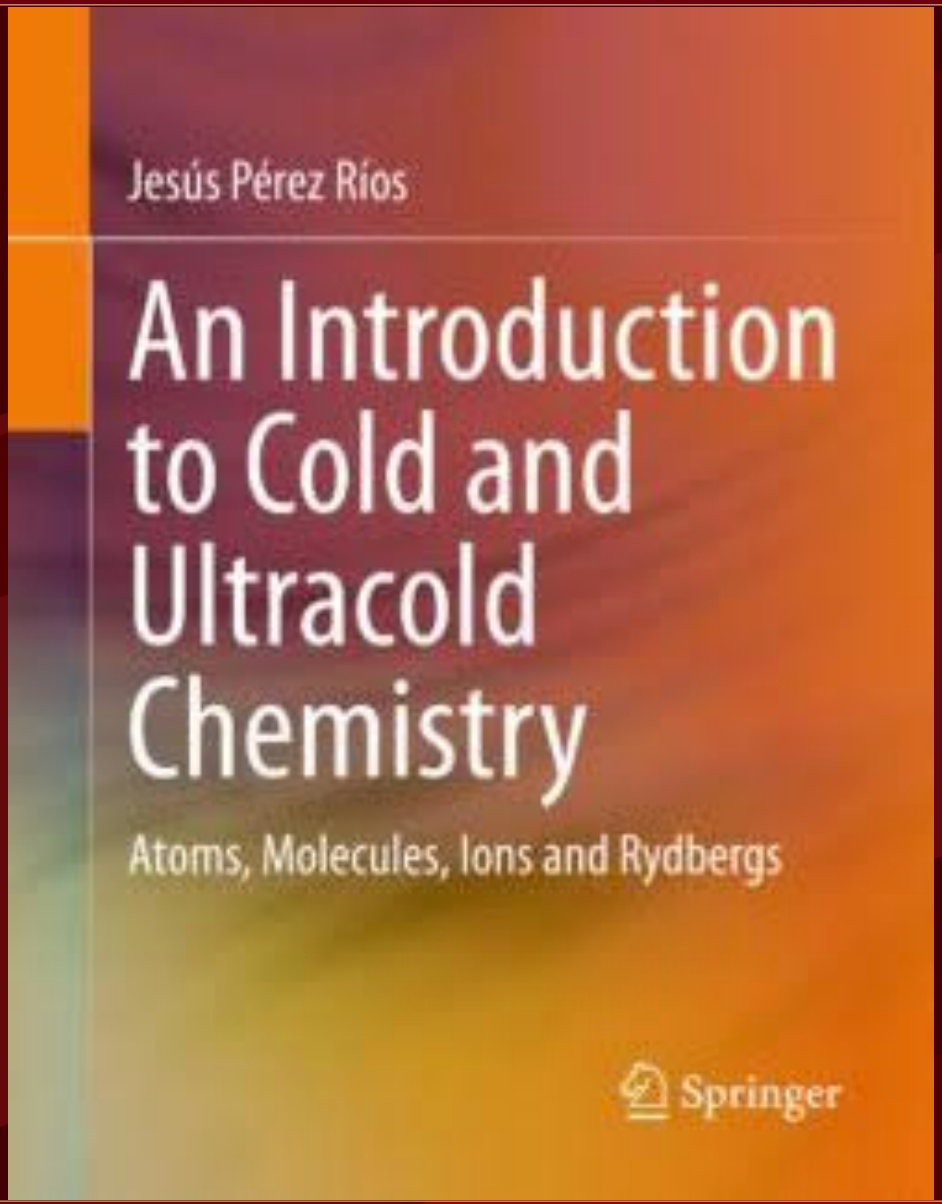
FULBRIGHT
Scholar Program

Kenneth Lanzetta Receives 2024-2025 Fulbright Scholar Award to Chile

Awardees engage in cutting-edge research, often continuing research collaborations started abroad, laying the groundwork for forging future partnerships between institutions. Congratulations to Dr. Lanzetta for this prestigious award!

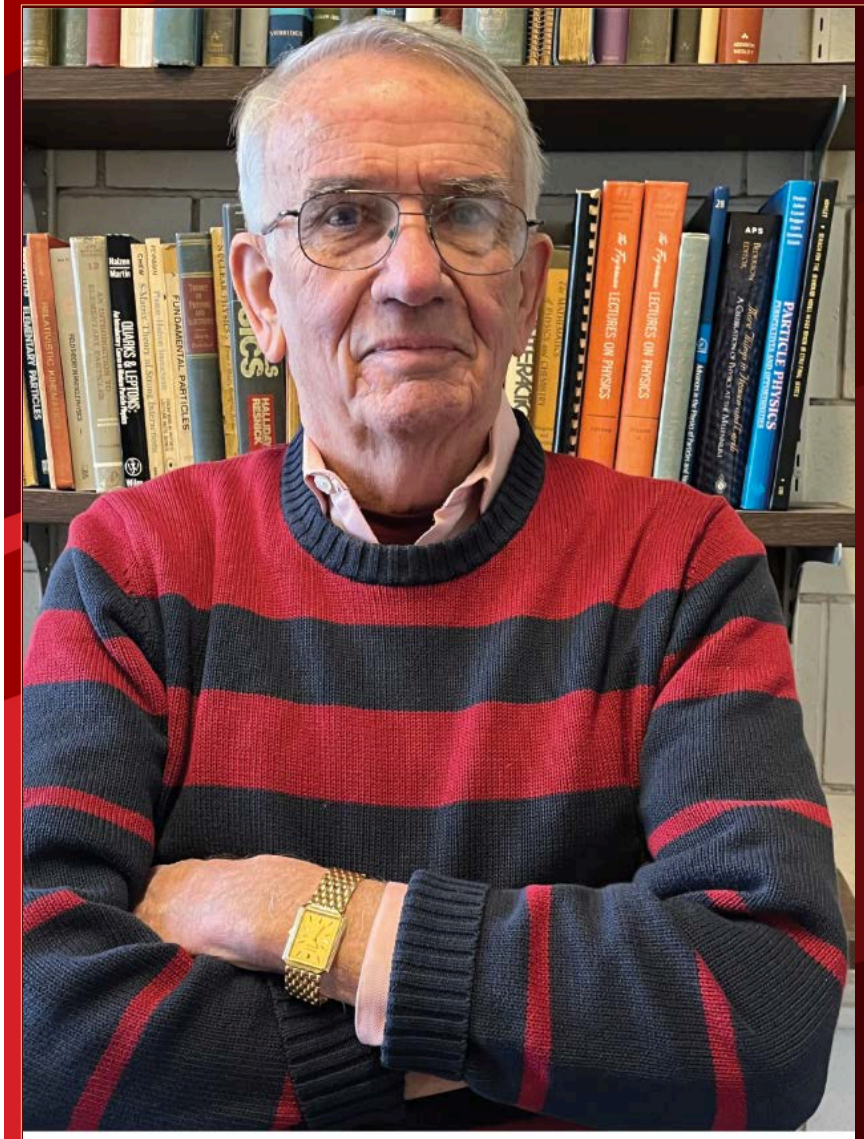
Congratulations to Ken!

Jesús Pérez Ríos Publishes His First Book



Congratulations to Jesús!

Autobiography of Paul Grannis on Annual Review of Nuclear and Particle Physics



NS74_Art01_Grannis ARjats.cls March 6, 2024 14:2

ANNUAL REVIEWS

Annual Review of Nuclear and Particle Science

An Experimental Life

Paul D. Grannis

Department of Physics, Stony Brook University, Stony Brook, New York, USA;
email: paul.grannis@stonybrook.edu

Congratulations to Paul!

2023-24 P&A Outstanding Faculty Award

Jan Bernauer

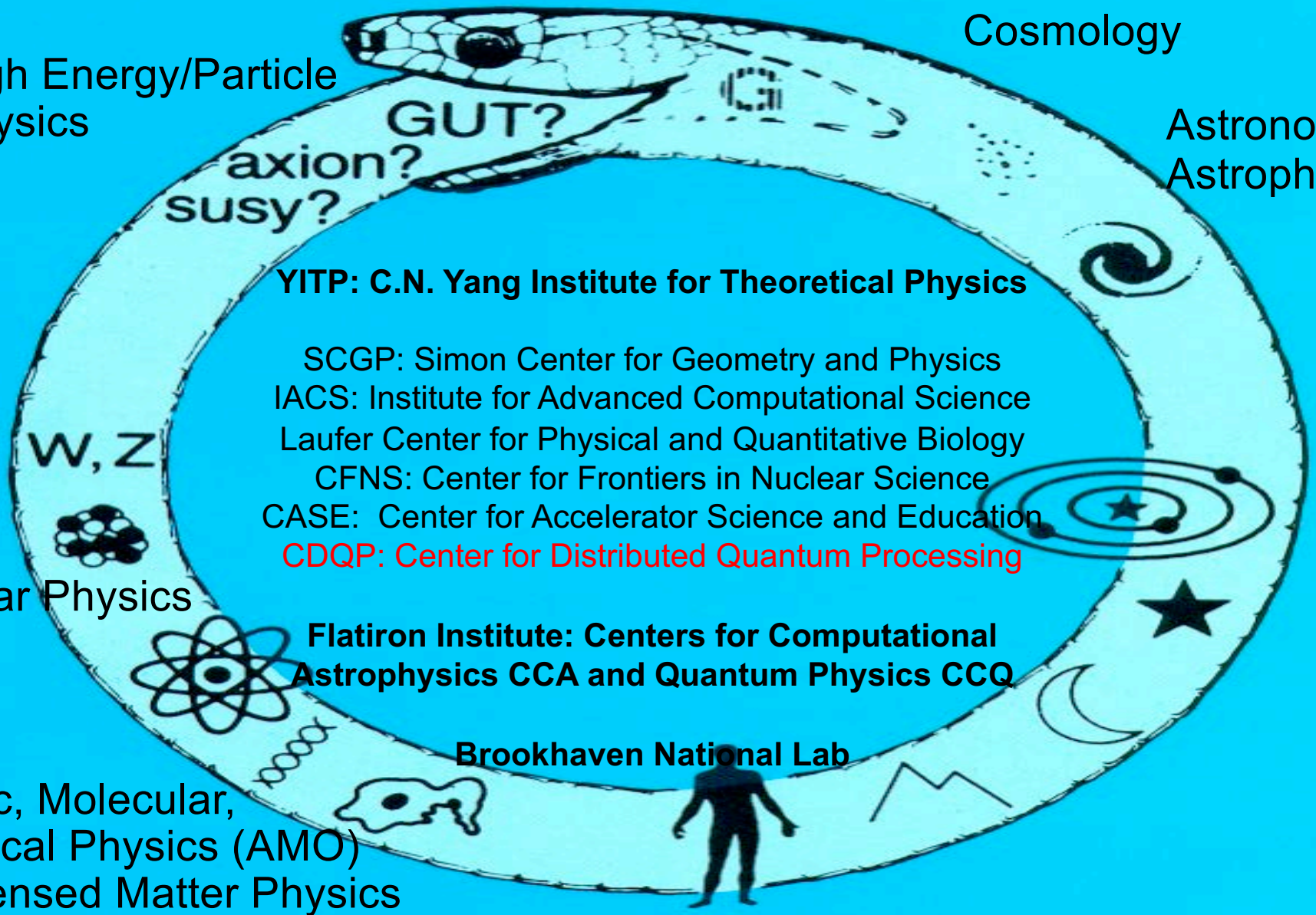
P&A Outstanding Faculty Award

Let's congratulate the faculty members for their promotions, retirements and honors, and welcome new faculty members!!!

A "Super-Compactified" Survey of Research Activities in the Department

Apologies for not being able to include all valuable contributions and possible inaccurate representation of the materials

Research Areas, Centers and Affiliated Institutions



YITP: C.N. Yang Institute for Theoretical Physics

SCGP: Simon Center for Geometry and Physics
IACS: Institute for Advanced Computational Science
Laufer Center for Physical and Quantitative Biology
CFNS: Center for Frontiers in Nuclear Science
CASE: Center for Accelerator Science and Education
CDQP: Center for Distributed Quantum Processing

Flatiron Institute: Centers for Computational Astrophysics CCA and Quantum Physics CCQ

Brookhaven National Lab

Astronomy/Astrophysics and Cosmology


Phil Armitage


Alan Calder


Simon Birrer


Will Farr


Jin Koda


Ken Lanzetta


Jim Lattimer


Vivian Miranda (YITP)


Rosalba Perna


Neelima Sehgal


Anja v.d. Linden


Fred Walter


Mike Zingale

Astronomy/Astrophysics and Cosmology

ASTRO GROUP: RESEARCH OVERVIEW

Overarching goal of: **Understanding the origin and evolution of our Universe, and the physical properties of the objects in them.**

In particular:

- Study of the early Universe with CMB observations (Sehgal, Miranda)
- Constrain Dark Matter and Dark energy via galaxy observations (von der Linden, Miranda, Sehgal, Birrer, Slosar), gravitational wave observations (Farr, Lattimer, Perna), and gravitational lensing (von der Linden, Sehgal, Perna, Birrer)
- Learn about galaxy properties and their evolution (von der Linden, Lanzetta, Birrer)
- Learn about properties of exotic compact objects (white dwarfs, neutron stars, black holes) both with observations (Walter, Lattimer) and with theoretical/computational methods (Lattimer, Zingale, Calder, Perna, Farr, Armitage, Swesty)
- Learn about the formation of stars (Walter) and planetary systems outside of our solar system (Armitage, Farr, Perna).

Stony Brook Cosmology (AST, BNL, Flatiron, YITP)

Faculty

- Simon Birrer
- Will Farr
- Anja von der Linden
- Vivian Miranda
- Rosalba Perna
- Neelima Sehgal
- Anze Slosar

Postdocs

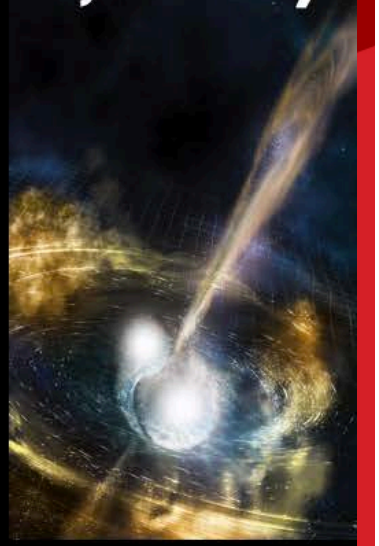
- Narayan Khadka
- Joshua Kable

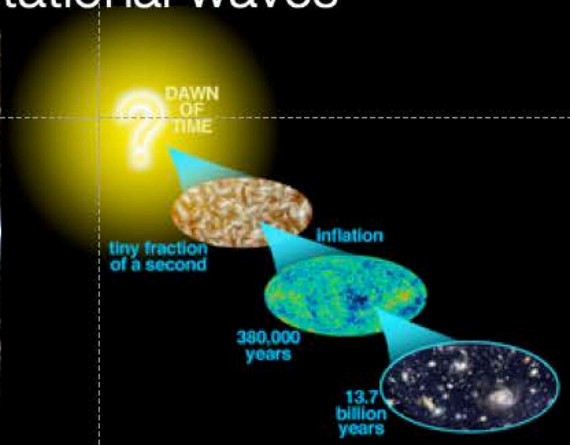
Students

- PhD students = 9
- Masters students = 6
- Undergrad students = 10

Research

Theoretical and observational cosmology: black holes, inflation, cosmic microwave background, dark energy, dark matter, galaxies and galaxy clusters, gravitational lensing, large-scale structure, neutrinos, 21 cm, gravitational waves





AdvACT, Simons Observatory, CMB-S4, and CMB-HD

Rubin Observatory

Computational and Nuclear Astrophysics

- Faculty / Postdocs
  - Alan Calder
  - James Lattimer
  - Doug Swesty
  - Michael Zingale
  - Rosalba Perna
  - Phil Armitage
- Grad Students
  - Khanak Bhargava
  - Brendan Boyd
  - Zhi Chen
  - Catherine Feldman
  - Eric Johnson
  - Josh Martin
  - Melissa Rasmussen
  - Sabina Sagynbayeva
  - Alexander Smith Clark
  - Boyang Sun
- Undergrads
  - Brianna Garcia
  - Parker Johnson (REU)
- Research Interests
  - Supernovae
  - X-ray bursts and novae
  - Magnetars
  - Accretion disks
  - Neutron star interiors
  - Gravitational Radiation
  - High performance computing
  - Verification and Validation
  - Open science / reproducibility

recent group meeting

Background image: merging white dwarf calculation run with our Castro hydrodynamics code.

Astronomy/Astrophysics and Cosmology

Selected List of Papers (with SBU students)

"Dimming the Lights: 2D Simulations of Deflagrations of Hybrid C/O/Ne White Dwarfs using FLASH."**C. Feldman**, et al. ApJ 959 112, 2003.

"Benchmarking with Supernovae: A Performance Study of the FLASH Code." **J. Martin, C. Feldman**, et al. Proceedings of PEARC 24 (Practice and Experience in Advanced Research Computing), 8, 1-9, 2024. Best Student Paper Prize.

"Tidal disruption events from three-body scatterings and eccentricity pumping in the discs of active galactic nuclei" **Prasad, C.**, Wang, Y., Perna, R. et al., MNRAS,531, 1409, (2024)

"Sensitivity of Simulations of Double-detonation Type Ia supernovae to Integration Methodology", M. Zingale, M., Z. Chen, M. Rasmussen, A. Polin, M. Katz, A. Smith Clark, E. Johnson, ApJ 966, 150, 2024

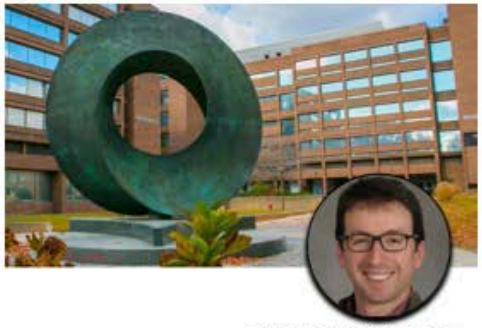
"Cosmological Parameter Forecasts for a CMB-HD Survey", A. MacInnis, N. Sehgal, M. Rothermel, PRD 109, 2024

"Introducing the Condor Arrary Telescope. 1. Motivation, Configuration, and Performance," K. Lanzetta, S. Gromoll, M. Shara, S. Berg, D. Valls-Gabaud, F. Walter, J. Webb, PASP 1043, id. 015002, 2023

"Introducing the Condor Arrary Telescope. II. Deep Imaging Observations of the Edge-On Spiral Galaxy NGC 5907 and the NGC 5866 Group: Yet Another View of the Iconic Stellar Stream," K. Lanzetta, S. Gromoll, M. Shara, S. Berg, J. Garland, E. Mancini, D. Valls-Gabaud, F. Walter, J. Webb, MNRAS 529, 197, 2024

"Compiled properties of nucleonic matter and nuclear and neutron star models from nonrelativistic and relativistic interactions," B. Sun, S. Bhattiprolu, J. M. Lattimer, Phys. Rev. C 109, 055801, 2024

Atomic, Molecular and Optical (AMO) Physics Group



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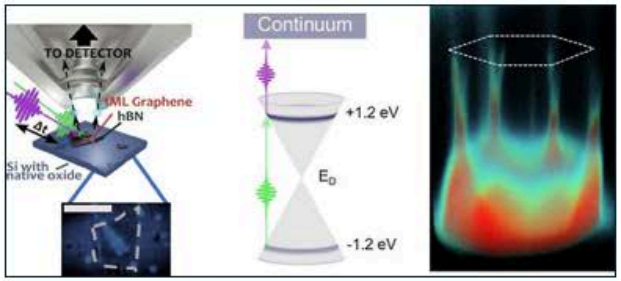
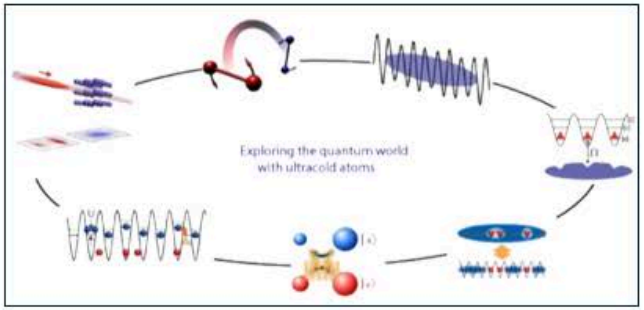
Research Group Website
Curriculum Vitae. (Last updated: 2023 Dec 12)

AMO Physics Group

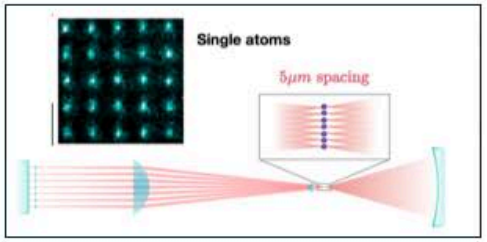
Ultrafast spectroscopy
Allison



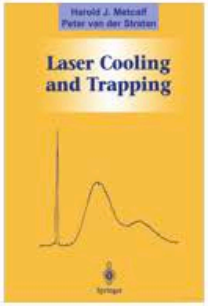
Ultracold quantum sciences
Schneble



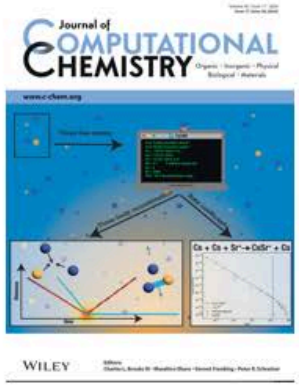
Cavity QED
Kumar



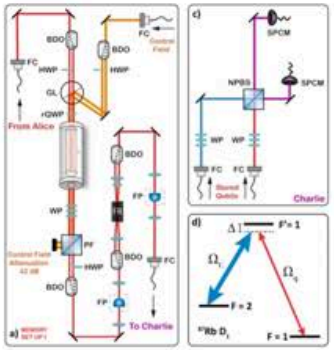
Laser cooling and trapping
Metcalf



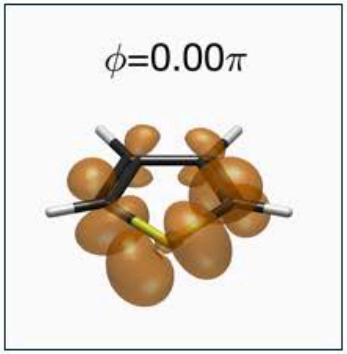
Few-body physics
Perez-Rios



Quantum Information
Figueroa



Ultrafast quantum control
Weinacht



AMO Physics Group

PHYSICAL REVIEW LETTERS 131, 263202 (2023)

Long-Lived Electronic Coherences in Molecules

Brian Kaufman,[1] Philipp Marquetand,[2] Tamás Rozgonyi,[3] and Thomas Weinacht[1]
[1]Department of Physics and Astronomy, Stony Brook University, Stony Brook, New York 11794-3800, USA
[2]University of Vienna, Faculty of Chemistry, Institute of Theoretical Chemistry, Währinger Strasse 17, 1090 Wien, Austria
[3]Wigner Research Centre for Physics, P.O. Box 49, H-1525 Budapest, Hungary

NANO LETTERS

pubs.acs.org/NanoLett Letter

Momentum-Space Observation of Optically Excited Nonthermal Electrons in Graphene with Persistent Pseudospin Polarization

Jin Bakalis, Sergii Chernov, Ziling Li, Alice Kunin, Zachary H. Withers, Shuyu Cheng, Alexander Adler, Peng Zhao, Christopher Corder, Michael G. White, Gerd Schönhense, Xu Du, Roland K. Kawakami, and Thomas K. Allison*

nature chemistry

Article https://doi.org/10.1038/s41557-024-01590-1

Collisional alignment and molecular rotation control the chemi-ionization of individual conformers of hydroquinone with metastable neon

Received: 23 January 2024
Accepted: 27 June 2024

L. Ploenes[1,6], P. Straňák[1,5,6], A. Mishra[1], X. Liu[2], J. Pérez-Ríos[3,4] & S. Willitsch[1]

npj | quantum information www.nature.com/npjqi

ARTICLE OPEN Check for updates

Hong-Ou-Mandel interference of single-photon-level pulses stored in independent room-temperature quantum memories

Sonali Gera[1,5], Chase Wallace[1,5], Mael Flament[2], Alessia Scriminich[3], Mehdi Namazi[2], Youngshin Kim[1], Steven Sagona-Stophel[1], Giuseppe Vallone[3], Paolo Villoresi[3] and Eden Figueroa[1,4]

AMO Physics Group

22 papers published: 1 **Nature Chemistry**, 1 **Nature Physics**, 1 Nature Quantum Information, 1 **Nano Letters**, 1 **Physical Review Letters** and 1 **Chem. Comm .**

- "Long-Lived Electronic Coherences in Molecules" **Brian Kaufman**, Philipp Marquetand, Tamas Rozgonyi, and Thomas Weinacht Phys. Rev. Lett. 131, 263202 (2023)
- "Ion solvation in atomic baths: from snowballs to ionic polarons" **Saajid Chowdhury**, and Jesús Pérez-Ríos Natural Sciences e20240006
- "Momentum-space Observation of Optically Excited Non-Thermal Electrons in Graphene with Persistent Pseudospin Polarization" **J. Bakalis**, S. Chernov, Z. Li, A. Kunin, **Z. H. Withers**, S. Cheng, A. Adler, C. Corder, M. G. White, G. Schönhense, X. Du, R. K. Kawakami, and T. K. Allison. Nano Lett. 24, 9353 (2024). DOI
- *"Exact solution of the collective non-Markovian decay of two fully excited quantum emitters"* **Alfonso Lanuza**, and Dominik Schneble, *Phys. Rev. Res. 6, 033196 (2024)*
- "The database of spectroscopic constants of diatomic molecules (DSCDM): A dynamic and user-friendly interface for molecular physics and spectroscopy" **Yueqian Wang, Daniel Julian, Mahmoud AE Ibrahim, Connor Chin, Saketh Bhattiprolu, Ethan Franco**, Jesús Pérez-Ríos, Journal of Molecular Spectroscopy 298, 111848 (2023)

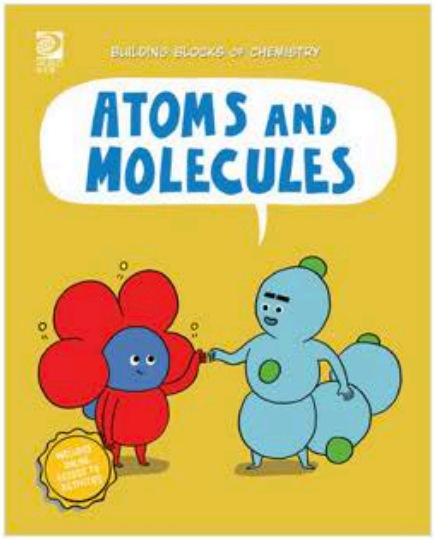
Undergrads

AMO Physics Group

If you like lasers …

Everyone likes lasers, after all!

If you want to know about the intimate life of atoms and molecules



Then, AMO is the right choice!

We have at least **5 PhD positions and more opportunities for undergraduates.**

Center for Distributed Quantum Processing

Prof. Eden Figueroa
(*Center Director*)
Quantum Information Technology

Prof. Dmitri Kharzeev
Nuclear Physics & Cond-Matter Theory

Prof. Qiang Li
Quantum Materials & Devices for QI

Prof. Ash Kumar
(joined 2024)
Quantum Science with Photons and Atoms

Prof. Dominik Schneble
Quantum Simulation with Ultracold Atoms

Prof. Tzu-Chieh Wei
(*Deputy Director*)
Theory in Quantum Info & Computation

Center for Distributed Quantum Processing

+ BNL collaborators

Inaugural Conference (10/23/2023)

- 150 attendees
- National and international speakers
- Young investigators talks

Center for Distributed Quantum Processing

Inaugural CDQP Graduate Fellows (Fall 2023)

Edoardo Buonocore

Anh Nghiem

David Frenklakh
(graduated summer 2024)
→ postdoc @ BNL

Dounan Du

Chase Wallace

Youngshin Kim (graduated spring 2024)
→ postdoc @ Harvard

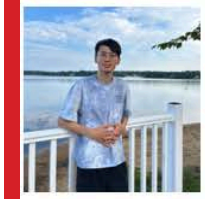
Zhixiang Hu
(graduated summer 2024)

New CDQP Graduate Fellows Cohort (Fall 2024)

Hongyi Huang (since summer 2024)

Leonardo Castillo
(new PhD student)

Luke Dyer
(QIST student)



Jacky Chen
(new PhD student)

Ivy Huang
(new PhD student)

Center for Distributed Quantum Processing

Selected Publications from CDQP members

"*Hong-Ou-Mandel interference of single-photon-level pulses stored in independent room-temperature quantum memories*," Sonali Gera, **Chase Wallace**, Mael Flament, Alessia Scriminich, Mehdi Namazi, **Youngshin Kim**, Steven Sagona-Stophel, Giuseppe Vallone, Paolo Villoresi, Eden Figueroa, npj Quantum Information 10, 10 (2024)

"*Super- and subradiant dynamics of quantum emitters mediated by atomic matter waves*," **Youngshin Kim**, **Alfonso Lanuza**, Dominik Schneble, arXiv:2311.09474

"*Quantum Algorithm For Solving Nonlinear Algebraic Equations*," **Nhat A. Nghiem** and Tzu-Chieh Wei, arXiv:2404.03810

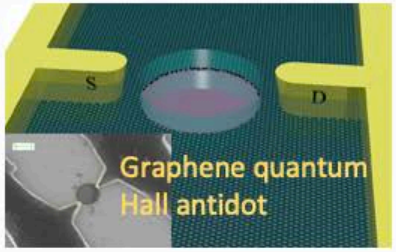
"*Bulk and boundary entanglement transitions in the projective gauge-Higgs model*," **Hiroki Sukeno**, Kazuki Ikeda, and Tzu-Chieh Wei, arXiv:2402.11738

"*Quantum simulation of entanglement and hadronization in jet production: lessons from the massive Schwinger model*," A Florio, **David Frenklakh**, K Ikeda, DE Kharzeev, V Korepin, S Shi, K Yu, arXiv:2404.00087

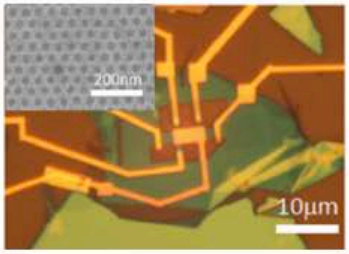
***students highlighted in boldface**

Experimental Condensed Matter Group

Quantum Transport in Low Dimensional Materials (Du)

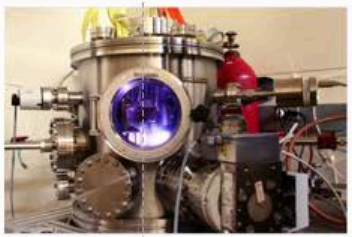


Quantum devices



Quantum metamaterials

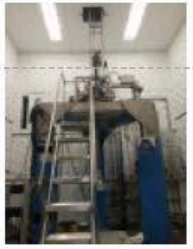
Artificially Layered Ferroelectric Oxides (Dawber)



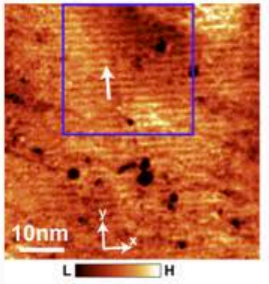
Growth and characterization of nanostructured oxide thin films

Synchrotron X-ray diffraction at the ISR and CHX beamlines at NSLS-II

Spectroscopic Characterization of Correlated Phenomena in Quantum Materials (Blackwell)

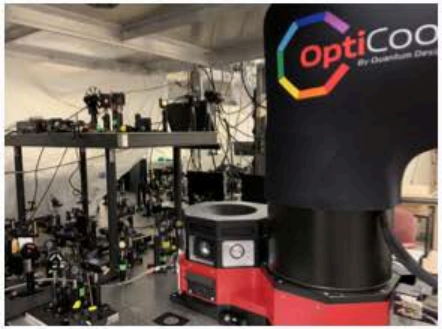


Scanning Tunneling Microscope

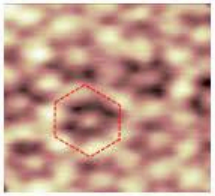


Spectroscopic imaging of superconducting film

Nano-scale Optical Spectroscopy of Quantum materials (Liu)

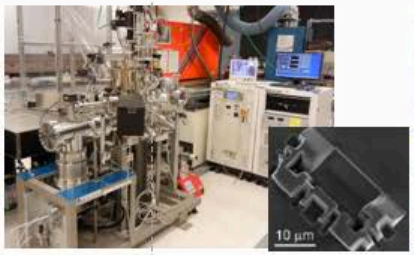


Optical/infrared nanoimaging in high magnetic field

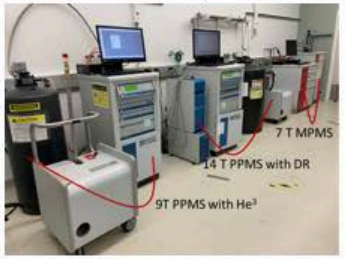


Moiré Photonics

Theory/AI/ML Guided Discovery of Quantum Materials/Phases (Li)



Single crystal (including high pressure) & thin film growth



Characterizations at ultra low T, high m-field, P

Selected papers with students/postdocs participations (2023 fall to 2024 summer):
(Blue: SBU students, Green: postdocs, Red: CMP-exp faculties, **Bold: Lead**)

- Probing Inhomogeneous Cuprate Superconductivity by Terahertz Josephson Echo Spectroscopy
  A. Liu, Pedro M Lozano, Q. Li, et al ***Nature Physics*** (2024, in press).

- Ultrathin Magnesium-Based Coating as an Efficient Oxygen Barrier for Superconducting Circuit Materials
  C. Zhou, Juntao Yao, Q. Li et al ***Advanced Materials*** 36, 2310280 (2024).

- Nano-Imaging of Landau-Phonon Polaritons in Dirac Heterostructures
  Lukas Wehmeier, Makoto Tsuneto, Michael Dapolito, Wenjun Zheng, Ran Jing...X. Du, Q. Li, ... **M. Liu** ***Science Advance*** (2024).

- Electronic interactions in Dirac fluids visualized by nano-terahertz spacetime mapping
  Suheng Xu, Ran Jing, M.Liu, et al. ***Science Advance***, in press (2024).

- Inhomogeneous Photosusceptibility of VO_2 Films at the Nanoscale
  A. J. Sternbach, M.Liu, et al., ***Phys. Rev. Lett.*** 132, 186903 (2024).

- Electronic structure, magnetic and transport properties of antiferromagnetic Weyl semimetal GdAlSi
  Antu Laha, Juntao Yao, Sarah Paone, Ran Jin, M. Liu... **Q. Li** ***Phys. Rev. B*** 109, 035120 (2024).

- Observation of anomalous thermal effect in $ZrTe_5$ using photothermal measurements
  Makoto Tsuneto, Ran Jing, Xinzhong Chen, **Q. Li**, and **M.Liu** et al., ***Phys. Rev. Applied*** 21, 034001 (2024).

- Accelerated Nano-Optical Imaging Through Sparse Sampling
  Fu, Matthew, Suheng Xu et al. ***Nano Lett.*** 24, 2149 (2024).

- Ultrabroadband Terahertz Near-Field Nanospectroscopy with a HgCdTe Detector,
  Lukas Wehmeier; **M.Liu,** Suji Park, Houk Jang, Christopher Homes, Lawrence (Larry) G. Carr, ***ACS photonics***, 10, 12, 4329–4339 (2023).

- Roadmap on Label-Free Super-Resolution Imaging
  Vasily N Astratov... M.Liu, et al. ***Laser Photonics Rev.*** 2200029 (2023).

Condensed Matter Experiment

Research opening

Liu - Nano-scale Optical Spectroscopy lab

2024 fall: PhD students (1), master students (1) undergraduate students (1)

2025 fall: PHD students (1), master students (2) undergraduate students (2)

Li – Quantum Materials Physics Lab

2024 fall: PhD students (2), master students (1) undergraduate students (1)

2025 fall: PHD students (2), master students (1) undergraduate students (1)

Du – Quantum Transport Lab

2024 fall: PhD students (1), master students (1) undergraduate students (0)

2025 fall: PHD students (2), master students (1) undergraduate students (1)

Condensed Matter Theory Group
(openings for grad students: ~3-4 Ph.D. and 3-4 MA)

Sasha Abanov:
Strongly correlated electrons

Dmitri Averin:
Mesoscopic physics

Jennifer Cano:
Topological materials

Cyrus Dreyer:
Electronic structure theory

Marivi Fernandez-Serra:
Electronic structure theory

Paul Goldbart:
Universality in soft random solids Controlling quantum fluids via measurements

Dmitri Kharzeev:
Chiral materials

Condensed matter theory group

Goal: To understand and predict material properties for discovery and applications

New materials platforms and novel phenomena:

2D materials
Topological materials
Superconductors
Liquid/solid interfaces

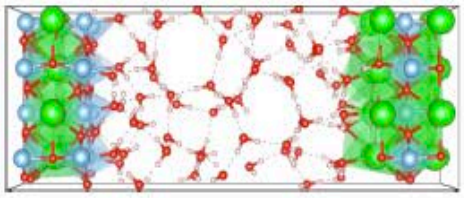
State-of-the-art computational and analytical methods:

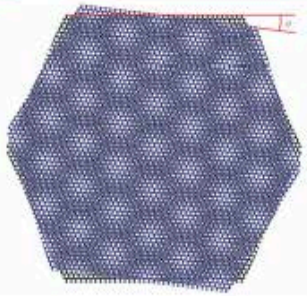
Electronic structure
Machine learning
Molecular dynamics
Many body methods
Statistical field theory

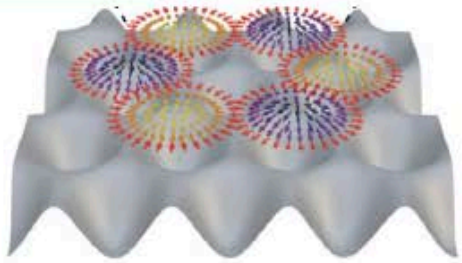
Connections to real-world applications:

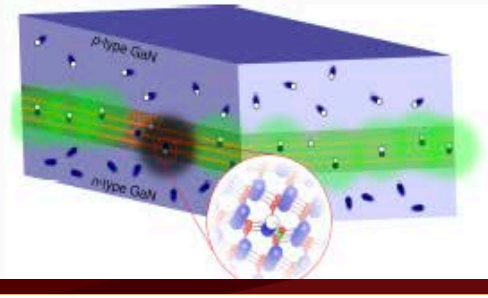
Electronic and optoelectronic devices

Dark matter detection
Quantum computing









Selected Papers

- Jennifer Cano:
  - Quantum geometry induced nonlinear transport in altermagnets, PRL (in press); **Yuan Fang**, Jennifer Cano, **Sayed Ali Akbar Ghorashi**
  - Altermagnetic Routes to Majorana Modes in Zero Net Magnetization, PRL (in press); **Sayed Ali Akbar Ghorashi**, Taylor Hughes, Jennifer Cano
  - Chiral model of twisted bilayer graphene realized in a monolayer, PRB; Valentin Crépel, **Aaron Dunbrack**, Daniele Guerci, John Bonini, Jennifer Cano

- Cyrus Dreyer:
  - Fully *ab-initio* all-electron calculation of dark matter-electron scattering in crystals with evaluation of systematic uncertainties, Cyrus E. Dreyer, Rouven Essig, Marivi Fernandez-Serra, **Aman Singal**, and Cheng Zhen. Phys. Rev. D, 2024

- Marivi Fernandez-Serra:
  - Anti-Coulomb ion-ion interactions: a theoretical and computational study; **Alec Wills, Anthony Mannino**, G-M, L-S,Soler and Fernandez-Serra, Physical Review Research, 2024
  - Flexoelectricity and surface polarization in water ice; Wen, Ma, **Anthony Mannino**, Fernandez-serra, Shen, Catalan. arXiv:2212.00323. Nat. Physics (under review).

- Students, Post-docs

Experimental Nuclear Physics

Faculty:

Jan Bernauer

Abhay Deshpande

Axel Drees

Tom Hemmick

Joanna Kiryluk

Research Faculty:
Ross Corliss,
Gabor David,
Roli Esha

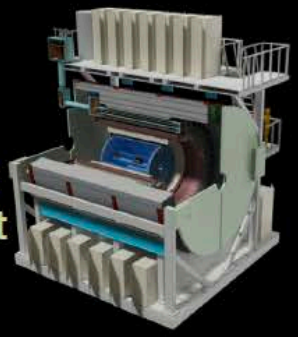
Nuclear Physics ranks #3 in US

Experimental Nuclear Physics

BROOKHAVEN NATIONAL LABORATORY

Bernauer, Corliss, David, Deshpande, Drees, Esha Hemmick

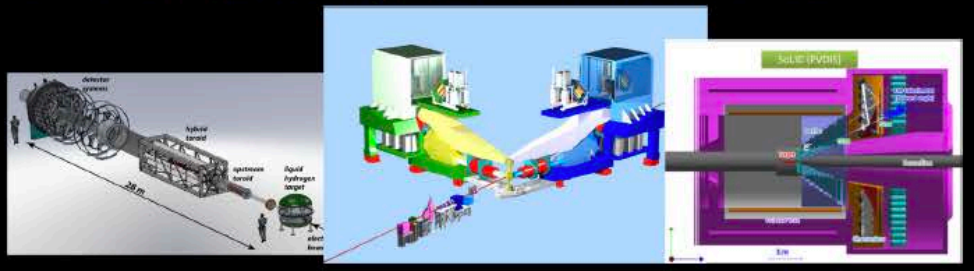
Quark Gluon Plasma
Spin Structure of Nucleon
Nucleon & Nuclear collisions with PHENIX and sPHENIX at RHIC



Detector installation and commissioning at sPHENIX

Deshpande

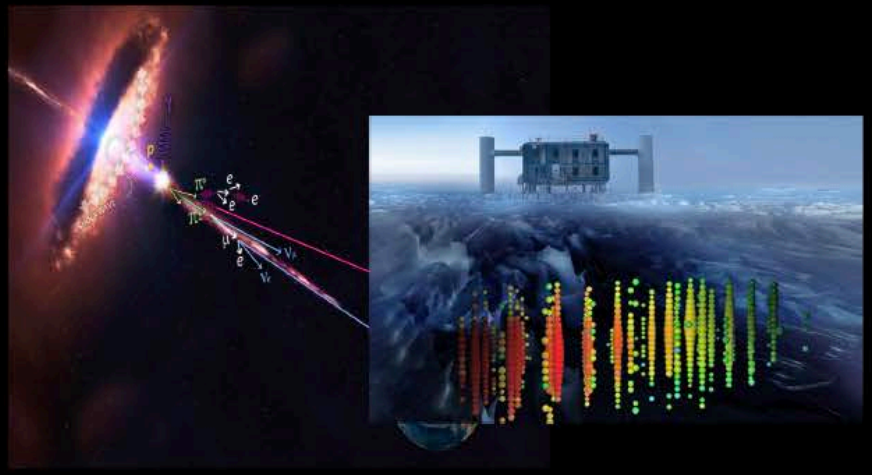
Fundamental symmetries, Nuclear & Nucleon structure
Electron scattering Hall A at 12 GeV CEBAF



MOLLER PREX/CREX SoLID

Kiryluk

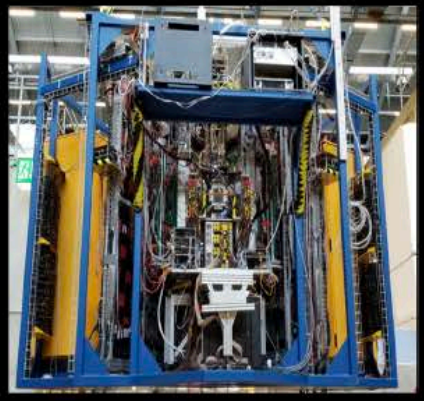
Astrophysical PeV neutrinos
IceCube Experiment at Antarctica



ICECUBE

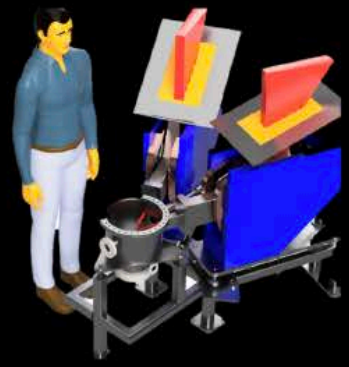
Bernauer, Corliss (DL)

Nucleon Structure, Proton Radius, BSM physics
Lepton Scattering MAMI, DESY, JLAB, PSI, TRIUMF



MUSE experiment at PSI:
Muon-proton scattering

DarkLight experiment at TRIUMF: X17 search



Electron Ion Collider & ePIC Detector

QCD and structure of nucleons

Electron Ion Collider (EIC)

Site selected also Critical Decision 0 : January 2020

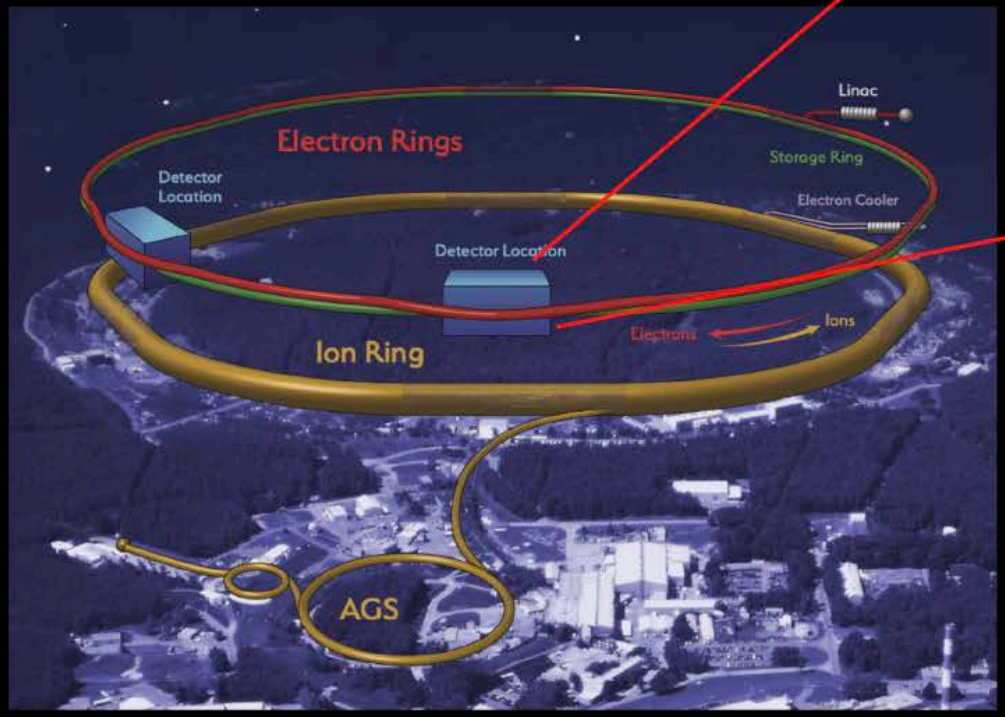
Critical Decision 1 : July 2021

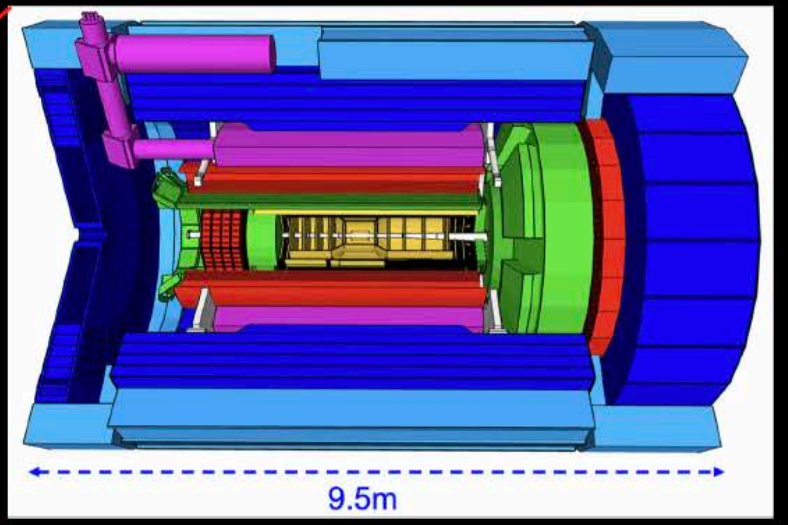
Experimental Proposal selected: March 2022

CD3A March 2023

CD2/3 2025 - Start Construction

CD4 2034





SBU is a major player in the Electron-Proton/ Ion Collider (ePIC) Detector proposal

Participation in particle ID, DAQ, beam polarimetry, simulations....

Bernauer, Corliss, Deshpande, Drees, Easha, Hemmick, Kiryluk

Deshpande was the founding Co-Ordinator and Founding Chair EIC Organization 2000- 2017

And since then, serves as EIC Science Director at BNL

BROOKHAVEN NATIONAL LABORATORY

sPHENIX and MOLLER Projects

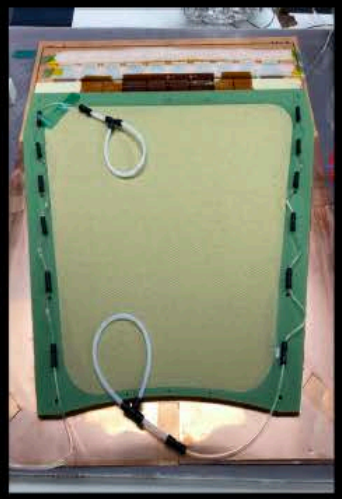
QGP Screening Length, Heavy Flavor Dynamics, Flow

sPHENIX Time Projection Chamber (TPC)

built in the Nuclear Structure Lab at SBU

A Heavy Ion collision seen by the TPC, Summer 2023

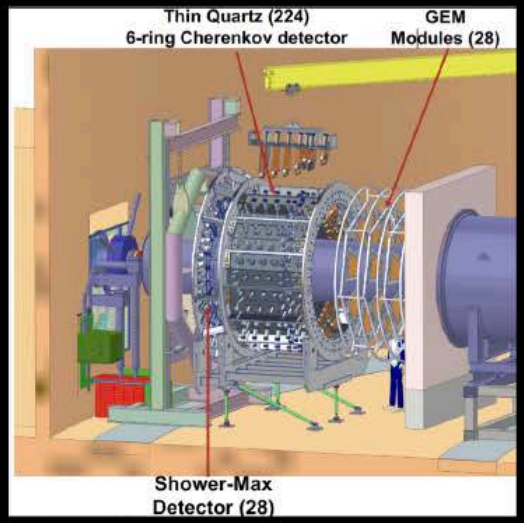
Hemmick also serves as the TPC L2 manager



Flavor and CP-conserving neutral currents, BSM physics

MOLLER GEM Tracker

under construction in the Nuclear Structure Lab at SBU



Bernauer, Corliss, David, Deshpande, Drees, Esha Hemmick

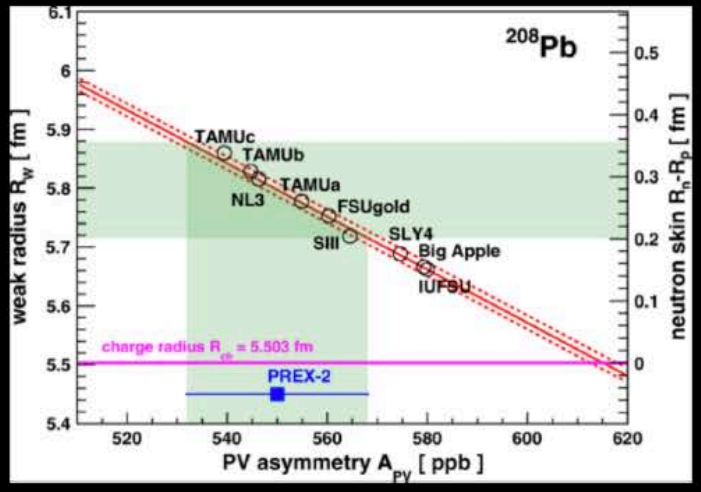
Events, News, and Awards

CFNS (5th) Summer School 2024
36 students from 10 countries + 21 lecturers

Recent Graduates of Our Group

(L to R) Nathan Shankman (MSI), Deijon James (BS), Abhay Deshpande, Allen Pierre-Louis (MS), Julian Driebeek (MSI)

Prof. Deshpande named interim Associate Laboratory Director for Nuclear and Particle Physics at Brookhaven National Lab



PREX Paper listed among 50 most influential QCD papers of the last 50 years by APS: "Accurate Determination of the Neutron Skin Thickness of 208Pb through Parity-Violation in Electron Scattering" D. Adhikari et al. Phys. Rev. Lett. 126, 172502 (2021)

Stony Brook University | Center for Nuclear Theory

Faculty:

D. Kharzeev

F. Ringer
(**starting in 2024**)

E. Shuryak

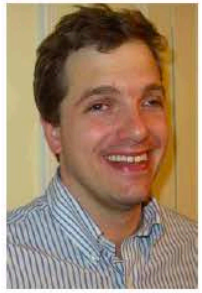
S. Syritsyn

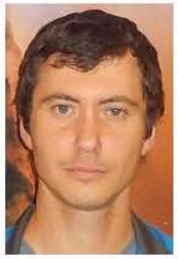
D. Teaney

J. Verbaarschot

I. Zahed





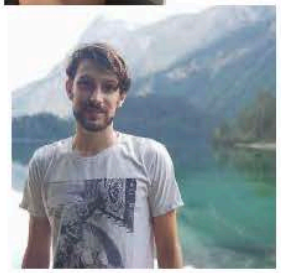

Postdocs:

S. Grieninger

K. Ikeda

A. Palermo





Students:

R. Amorosso

J. Bhambure

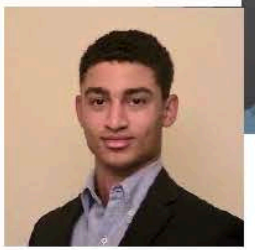
D. Frenklakh

J. Leeman

N. Miesch

W.Y. Liu

S. Shalamberidze




Additional info about the CNT:

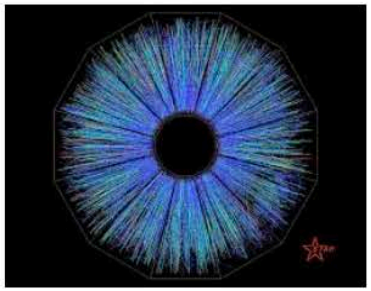
www.stonybrook.edu/cnt/

Center for Nuclear Theory

Research in all areas of modern nuclear physics:

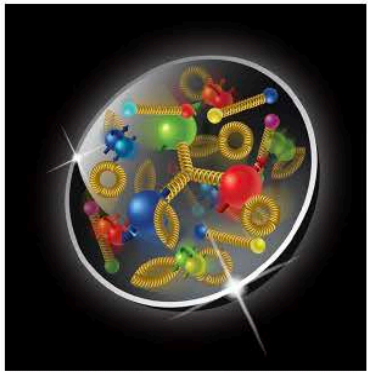
1. Finite temperature QCD and heavy ion collisions at RHIC and LHC

E. Shuryak, D. Teaney, D. Kharzeev, I. Zahed



2. Non-perturbative QCD and the structure of nucleons and nuclei at EIC

S. Syritsyn, I. Zahed, D. Kharzeev, E. Shuryak, D. Teaney, J. Verbaarschot

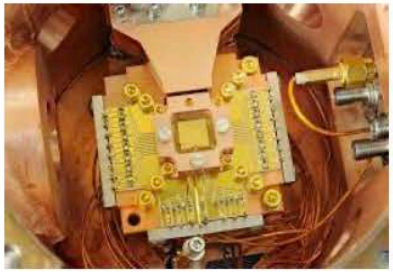


3. Quantum information science and nuclear physics

D. Kharzeev, J. Verbaarschot, S. Syritsyn, D. Teaney, I. Zahed

4. Cross-disciplinary connections of nuclear theory

D. Kharzeev, E. Shuryak, J. Verbaarschot, D. Teaney, I. Zahed



Research Highlights

[news media coverage]

Quantamagazine

SERIES 2023 IN REVIEW

The Year in Physics

Quantum Magic

In a feat reminiscent of a magic trick, scientists reported earlier this year that they had pulled energy out of a vacuum. Or had they? Rather than conjuring something from nothing, physicists managed to teleport energy over microscopic distances. The leap worked because the team exploited the strange properties of the quantum vacuum — a peculiar type of nothing that is actually imbued with a sort of sizzling quantum energy.

Demonstration of Quantum Energy Teleportation on Superconducting Quantum Hardware

Kazuki Ikeda (池田一毅)
Phys. Rev. Applied **20**, 024051 – Published 21 August 2023

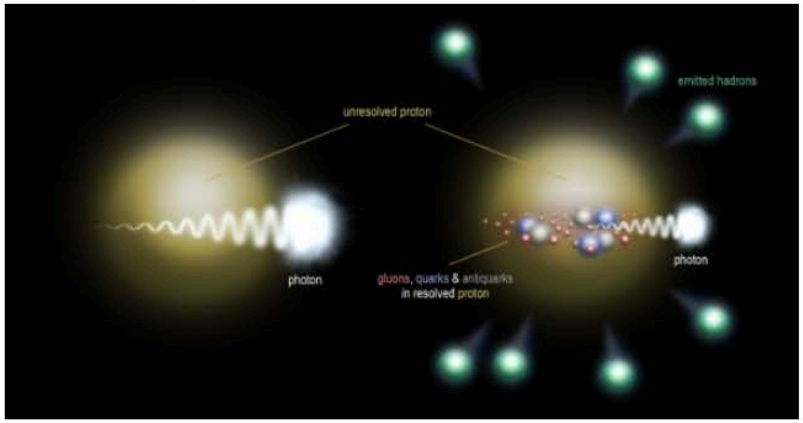
Ikeda → new faculty in U. Mass, Boston starting this fall

PHYS.ORG

EurekAlert! | AAAS

SciTechDaily

Interior of protons is maximally entangled



Probing the Onset of Maximal Entanglement inside the Proton in Diffractive Deep Inelastic Scattering

Martin Hentschinski, Dmitri E. Kharzeev, Krzysztof Kutak, and Zhoudunming Tu
Phys. Rev. Lett. **131**, 241901 – Published 13 December 2023

MARCH 19, 2024 Editors' notes

Cracking the quantum code: Simulations track entangled quarks

Real-Time Nonperturbative Dynamics of Jet Production in Schwinger Model: Quantum Entanglement and Vacuum Modification

Adrien Florio, David Frenklakh, Kazuki Ikeda, Dmitri Kharzeev, Vladimir Korepin, Shuzhe Shi, and Kwangmin Yu

Selected list of papers

- **N. Miesch,** E. Shuryak, I. Zahed, "Hadronic structure on the light front IX: Orbital-spin-isospin wave functions of baryons", Phys. Rev. D 108, 094033 (2023)
- **W.-Y. Liu,** E. Shuryak, I. Zahed, ""Hadronic structure on the light front VIII: Light scalar and vector mesons", Phys. Rev. D 109, 074029 (2024)
- **D. Frenklakh,** D. Kharzeev, G. Rossi, G. Veneziano, "Baryon-number – flavor separation in the topological expansion of QCD", JHEP 07 (2024) 262
- A. Florio, **D. Frenklakh,** K. Ikeda, D. Kharzeev, V. Korepin, S. Shi, K. Yu, "Real-time nonperturbative dynamics of jet production in Schwinger model: quantum entanglement and vacuum modification", Phys. Rev. Lett. 131 (2023) 2, 021902
- G. Basar, **J. Bhambure**, R. Singh, D. Teaney, "The stochastic relativistic advection diffusion equation from the Metropolis algorithm", arXiv:2403.04185
- **R. Amorosso**, S. Syritsyn, "Entanglement entropy due to the presence of static quarks", PoS Lattice2023 (2024) 382
- **A.Garcia-Garcia**, L. Sa, J. Verbaarschot, C. Yin, "Toward a classification of PT-symmetric quantum systems: from dissipative dynamics to topology and wormwholes", Phys.Rev.D109, 105017 (2024)

New research openings

No new openings at present, unfortunately –

but please do check with us next year!

New assistant prof. Felix Ringer may have a position or two.

High Energy Physics (HEP) Group

Hadron Collider Group – ATLAS at LHC


Hannah Arnold


Valerio Dao


John Hobbs


Giacinto Piacquadio

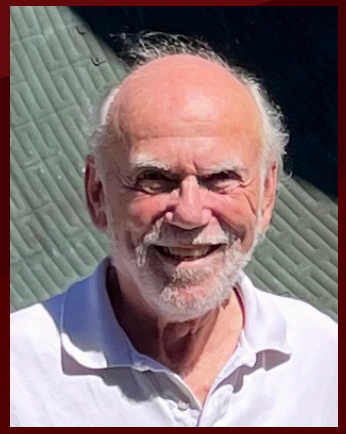

Dmitri Tsybychev

Neutrino and Nucleon decay Group – T2K, DUNE LIGO/Independent


Chang Kee Jung


Clark McGrew


Ciro Riccio


Barry Barish

High Energy Experiment: ATLAS Group

Faculty: Arnold, Dao, Da Via, Hobbs, Piacquadio, Tsybychev

Research Scientists: Chris Bee, Dean Schamberger

Post docs: Egor Antipov, Yesenia Jimenez, Martino Tanasini, Fang-Ying Tsai *+ 2 more in this year*

Ph.D.: Neil Anderson, Shanjia Liu, Mars Lyukova, Storm Lin, Chamathka Wijewardhana, Keyi Chen

Masters: Tyler George, Ning Ni, Shangke Zhou, Tianchi Huang, Zhanyu Liu

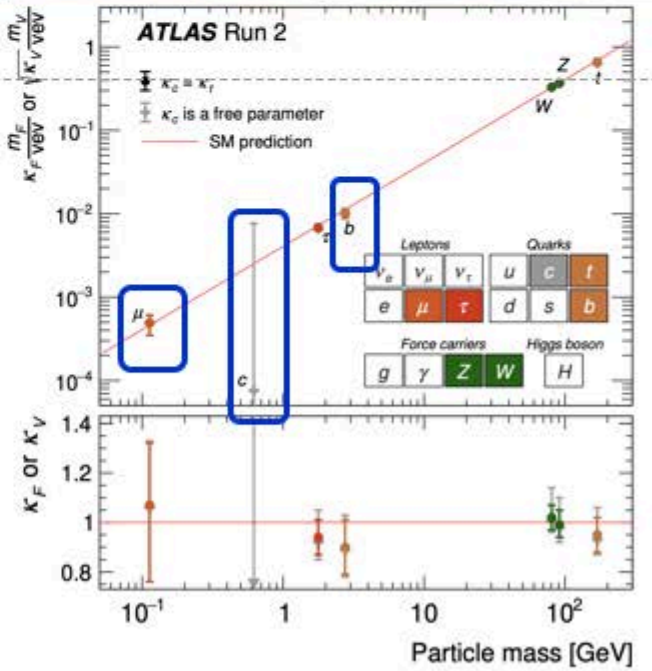
Undergrad: Zahin Shahrior

Research program primarily related to ***Higgs Boson***

- *Measuring properties in:*
  H→bb, H→cc, H→μμ, H→bbττ, HH→leptons
- *Anomalous interactions in pp → WW:*
  Higgs intermediate in this process and quartic gauge interactions
- *Searching for new physics:*
  Heavy Higgs, H' → WW
  Light pseudoscalars, H → aa → μμbb
- *Higgs analyses at future e+e- collider*

Detector operation (calorimeter) and construction / R&D / design (calorimeter and silicon detector).

An opportunity to design and build equipment!



Nature 607, 52-59 (4. July 2022)

Verify coupling of Higgs boson to fermions (bosons) is proportional to particle mass (mass^2).

Recent Physics Highlights of the ATLAS Stony Brook group

(*) ATLAS coordination roles

Search for New Phenomena in Two-Body Invariant Mass Distributions Using Unsupervised Machine Learning for Anomaly Detection at $\sqrt{s} = 13$ TeV with the ATLAS Detector

G. Aad *et al.* (ATLAS Collaboration)
Phys. Rev. Lett. **132**, 081801 – Published 20 February 2024

D. Tsybychev

Search for the nonresonant production of Higgs boson pairs via gluon fusion and vector-boson fusion in the $b\bar{b}\tau^+\tau^-$ final state in proton-proton collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector

G. Aad *et al.* (ATLAS Collaboration)
Phys. Rev. D **110**, 032012 – Published 9 August 2024

Storm Lin, **Valerio Dao**, G. Piacquadio

High Energy Physics - Experiment *Accepted by JHEP*

(Submitted on 30 May 2024)

Search for non-resonant Higgs boson pair production in final states with leptons, taus, and photons in pp collisions at $\sqrt{s}$ = 13 TeV with the ATLAS detector

ATLAS Collaboration

Yesenia Jimenez(*), John Hobbs

Report number	ATLAS-CONF-2024-010
Title	**Measurements of W H and Z H Higgs production with decays into bottom quarks and direct constraints on the charm Yukawa coupling with 13 TeV collisions in the ATLAS detector.**
Corporate Author(s)	The ATLAS collaboration
Publication	2024. *Soon to EPJC*

Yan Ke, Martino Tanasini, **Hannah Arnold(*)**, Giacinto Piacquadio, Valerio Dao

High Energy Physics - Experiment *Submitted to JHEP*

(Submitted on 18 Jul 2024)

Measurement of $t\bar{t}$ production in association with additional b-jets in the $e\mu$ final state in proton-proton collisions at $\sqrt{s}$=13 TeV with the ATLAS detector

ATLAS Collaboration

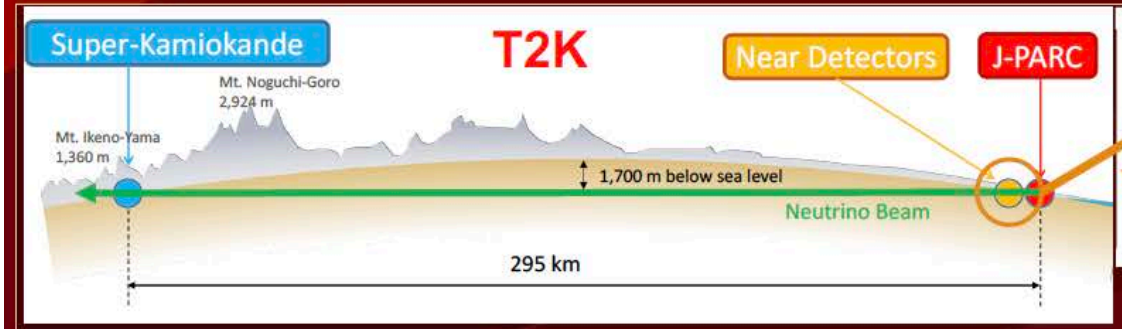
E. Antipov

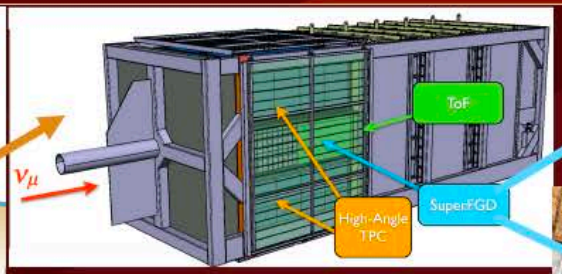
Stony Brook Neutrino and Nucleon decay (NN) Group

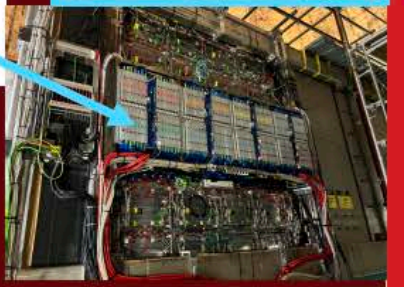
Scan me

- Faculty: C.K. Jung, C. McGrew, C. Riccio
- Research Faculty: C. Yanagisawa
- Adjunct Faculty: X. Qian (BNL), E. Worcester (BNL), M. Wilking (Minnesota)
- Postdocs: T. Doyle, W. Shi, U. Yevarouskaya
- Graduate Students: S. Liu, A. Teklu, J. Larkin, J. Jiang, M. Jia, J. Ji, Y. (Flynn) Guo, H. Zheng, J. Smith, K. Mahtani, R. Fanantenana Razakamiandra, A. Heindel

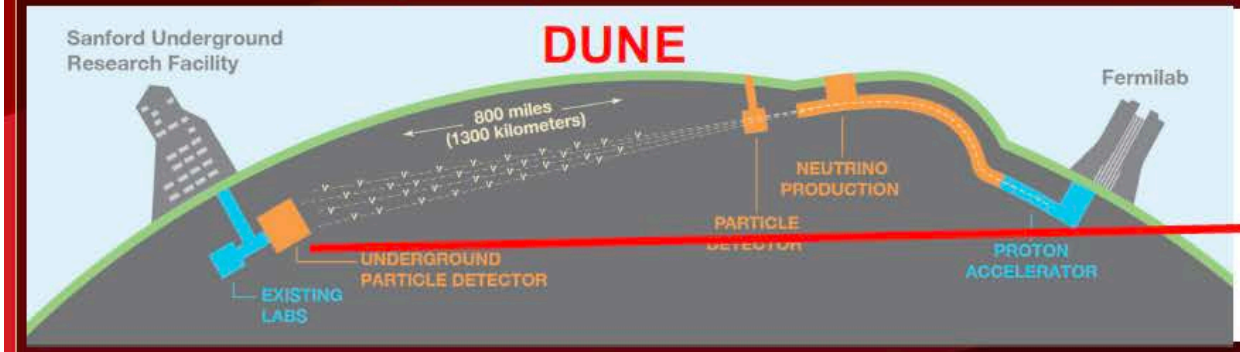
NN Group Research Overview

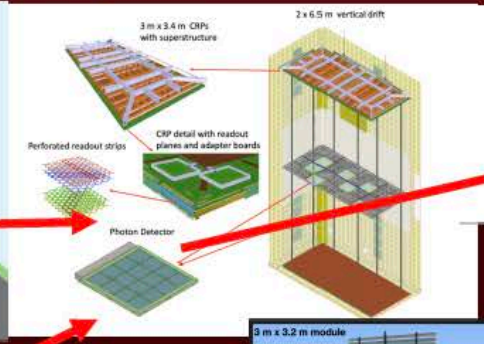


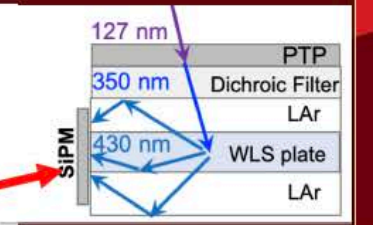


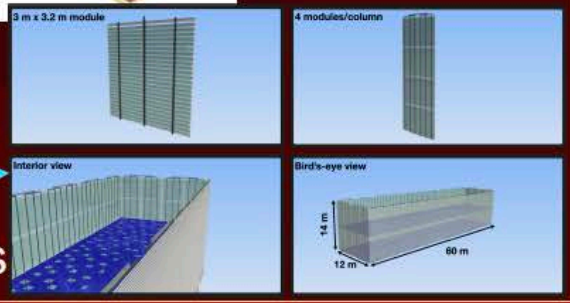


- Current generation: T2K experiment in Japan
  - Group heavily involved in all aspect of the experiment
  - ND280 upgrade installation completed, now taking data
  - T2K-only and joint SK+T2K and T2K+NOvA analyses









- Next generation: DUNE experiment in US
  - Photon detection system for second far detector module
  - Phase II third far detector module
  - Proposing a new tool (GUNDAM) for Oscillation Analysis

NN Group recent publications and positions open

- T2K and Super-Kamiokande Collaboration (Grad student contributing: J. Jiang, M. Jia), “First joint oscillation analysis of Super-Kamiokande atmospheric and T2K accelerator neutrino data”, arXiv:2405.12488 (2024) submitted to PRL
- A. Agarwal *et al.* (Grad student contributing: A. Teklu), “Total Neutron Cross-Section Measurement on CH with a Novel 3D-Projection Scintillator Detector”, Phys. Lett. B 840 (2023) 137843
- T2K Collaboration (Grad student contributing: K. Wood), “Measurements of neutrino oscillation parameters from the T2K experiment using 3.6E21 protons on target”, Eur. Phys. J. C 83 (2023) 9, 782
- CAPTAIN Collaboration (Grad student contributing: S. Martynenko), "Measurement of the Neutron Cross Section on Argon Between 95 and 720 MeV," Phys. Rev. D 107, 072009 (2023)
- DUNE Collaboration (Grad student contributing: J. Jiang, M. Jia), “Design, construction and operation of the ProtoDUNE-SP Liquid Argon TPC," JINST 17 (2022) no.01, P01005

Positions open: 2 grad students, 2 masters and a few undergrads (paid)

C.N. Yang Institute for Theoretical Physics [YITP] (I)

Broad Coverage of Theoretical Physics

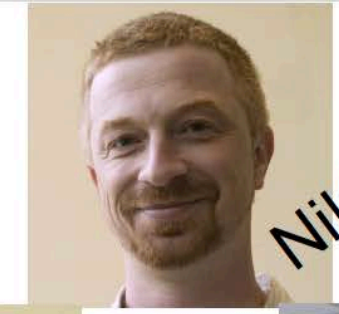
Quantum information, statistical mechanics
Particle and collider physics, dark matter, cosmology
Field & string theory, mathematical physics

20+ students working in a variety of areas. Study is arranged as with other DPA faculty and research groups. SCGP Physics Permanent Members are YITP Faculty

-- Collaborating with the Department & maintaining strong ties to Brookhaven theory groups, including opportunities for student research.

The full faculty . . .

Y

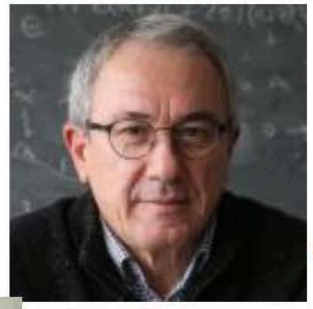


Nikita

I

Concha

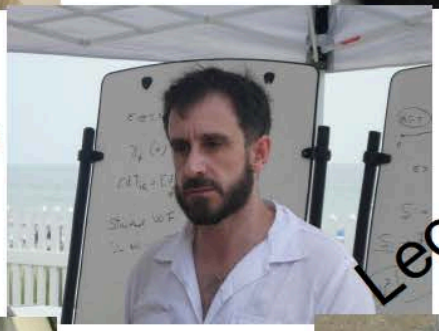
T



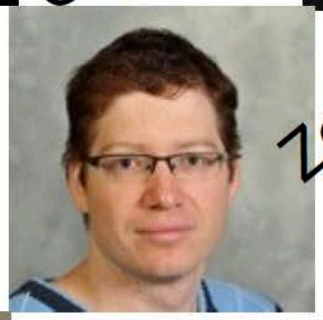
Luis

P

George



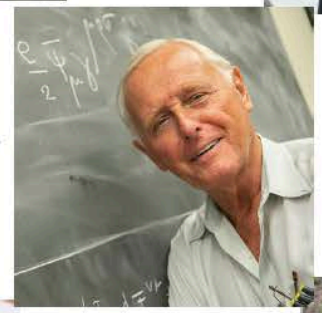
Leonardo



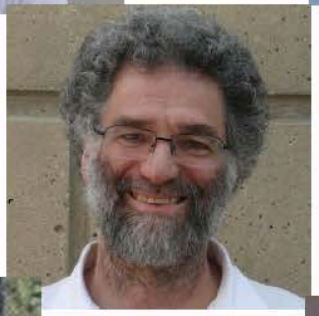
Zohar

Rouven

Peter



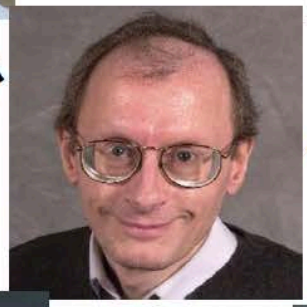
Martin



Vladimir

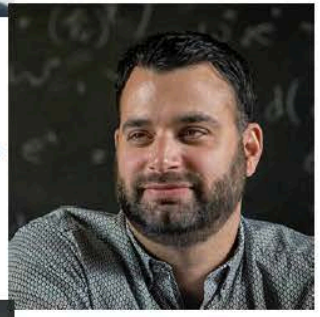
Shu-Heng

Tzu-chieh



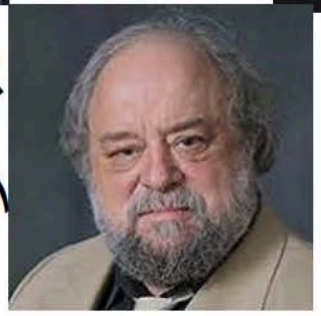
Robert

Patrick



Vivian

Alexander (Sasha)

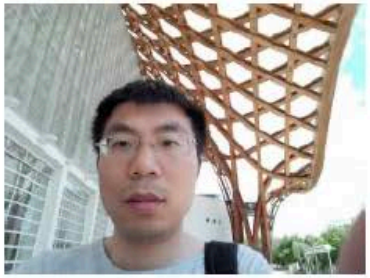


JoAnne (BNL)

(Not shown Barry, Fred, Warren)

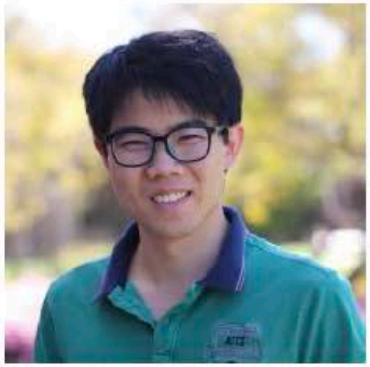
And coming soon to an office near you …

- Yin-Chen He (Jan 2025)



Nonperturbative quantum field theory, Condensed Matter

- Nathanan Tantivasadakarn (Sept 2025)



Quantum information

YITP (III)

Examples of recent publications, with students.

High Energy Physics, Astrophysics & Cosmology, . . .

Dimension-eight Standard Model basis for universal standard model effective field theory

Jay Desai, Maria C. Gonzalez-Garcia, et al

Solar reflection of dark matter with dark-photon mediators

Hailin Xu, T. Emken, Rouven Essig

Modeling nonlinear scales with COLA: preparing for LSST-Y1

Jonathan Gordon, Vivian Miranda, et al.

Cosmo group preparing:

YITP (IV)

Fields, Strings & Math-Phys . . .

Where is tree-level string theory?

Jan Albert, Waltraut Knop**, Leonardo Rastelli*

** Gerald Brown Award ** Marburger Fellowship*

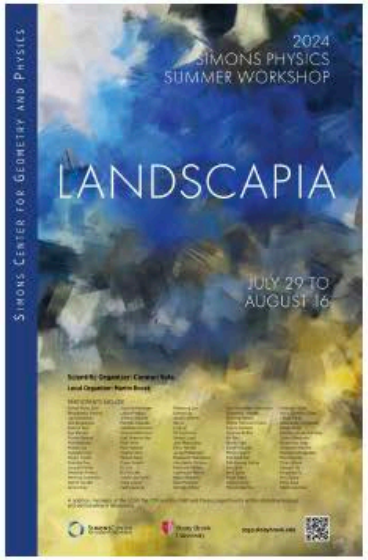
Celestial gluon and graviton OPE at loop level

Hare Krishnna

Local infrared safety in time-ordered perturbation theory

Aniruddha Venkata, George Sterman

21st Simons Summer Workshop.
Martin Rocek et al. bringing the world to Stony Brook each summer



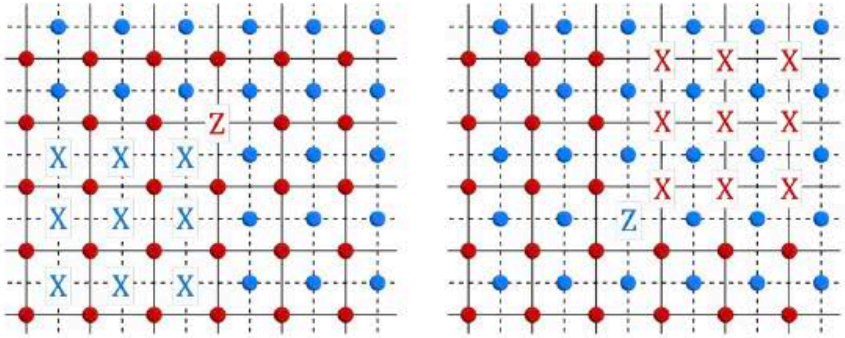
YITP (V)

Quantum Information, Condensed Matter and Related . . .

Kennedy-Tasaki transformation and non-invertible symmetry …

Aswin Parayil Mana, Yabo Li, Hiroki Sukeno, Tzu-Chieh Wei

The transformation:



Bulk and boundary entanglement transitions in the projective gauge-Higgs model …

Hiroki Sukeno, K. Ikeda, Tzu-Chieh Wei

+ many ongoing projects in "beyond standard model"; dark matter & astroparticles; cosmology; neutrino and QCD phenomenology; field & string theory, bootstrap and conformal, solvable models, quantum information . . .

SCGP

SIMONS CENTER FOR GEOMETRY AND PHYSICS

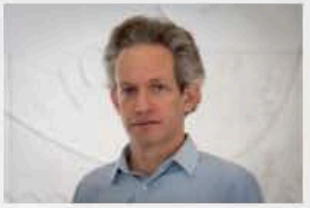
Stony Brook University

Mission

- Research in Theoretical Physics snd Geometry, understood in general terms
- Service to the community. Organizing and running workshops and programs
- Outreach for the university and the community around it

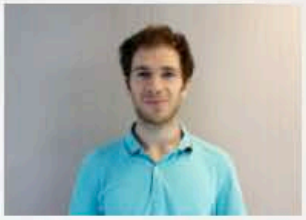
Simons Center Senior Faculty (Physics and Math)

Director: Luis Álvarez-Gaumé (Physics)

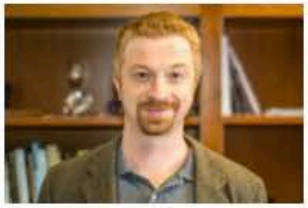


Deputy Director: Samuel Grushevsky (Math)

Zohar Komargodski (Physics)



John Pardon (Math)



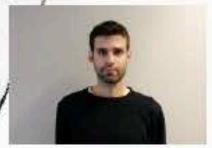
Nikita Nekrasov (Physics)

SIMONSCENTER Stony Brook University

Simons Center - Current postdocs

PHYSICS

Mykola Dedushenko



Diego Delmastro

Pietro Ferrero

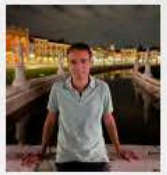
Justin Kulp

Avia Raviv-Moshe

Adar Sharon

MATH

Gorapada Bera



Juan Munoz-Echaniz

Filip Zivanovic

SimonsCenter Stony Brook University

Seminars and Events

Regular Seminars

SCGP Weekly Talk: Tuesday, 1:15pm, SCGP 102

- Colloquium style talk for general audience of physicists and mathematicians

Physics Seminar: Wednesdays, 2:00pm, SCGP 313

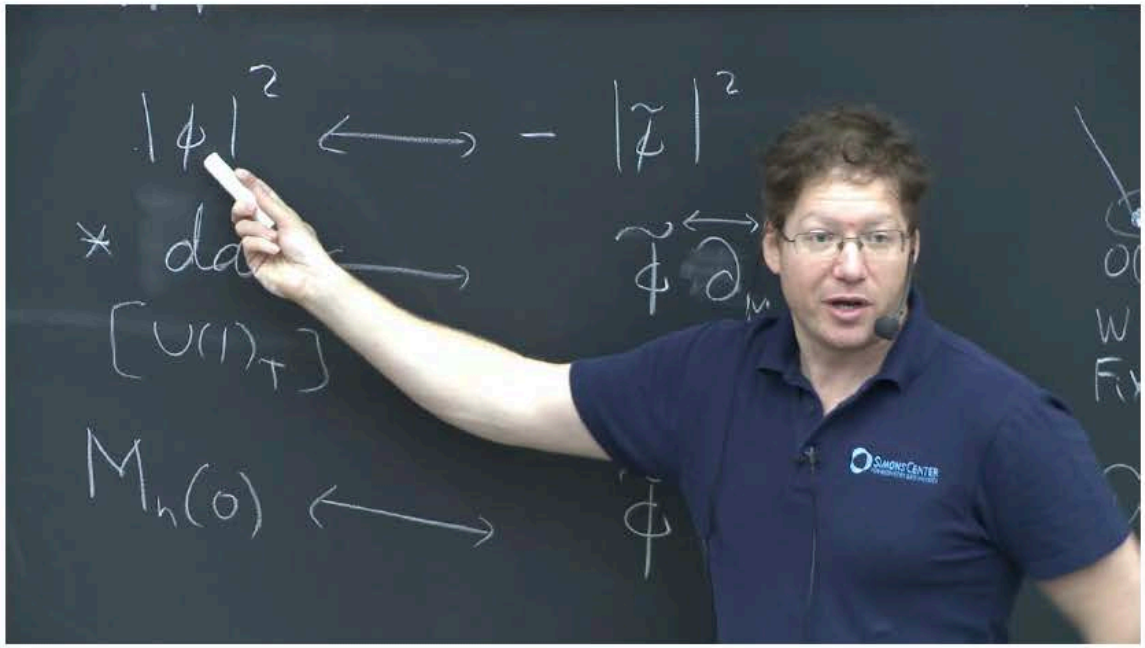
- Theoretical physics seminar

Special Events

Follow http://scgp.stonybrook.edu for all updated schedules and announcements of public lectures, art and cultural events, etc

Uppsala University Awards Prestigious Honorary Doctorate to Prof. Nikita Nekrasov

Prof. Zohar Komargodski invited to give the prestigious Giulio Racah Lecture at HUJI



2024-2025 Academic Year Programs

Start	End	Event
2024-09-03	2024-10-11	Non-Hermitian topology, geometry and symmetry across physical platforms
2024-10-14	2024-11-22	Random paths to QFT: New probabilistic approaches to field theory
2025-01-06	2025-02-28	Recent developments in higher genus curve counting
2025-03-17	2025-04-18	Supersymmetric Quantum Field Theories, Vertex Operator Algebras, and Geometry
2025-05-12	2025-06-13	Black hole physics from strongly coupled thermal dynamics

2024-2025 Academic Year Workshops

Start	End	Event
2024-07-01	2024-07-19	2nd Simons Math Summer Workshop: Moduli
2024-07-29	2024-08-16	21st Simons Physics Summer Workshop
2024-09-09	2024-09-13	Applications of Generalized Symmetries and Topological Defects to Quantum Matter
2024-09-23	2024-09-27	Non-Hermitian topology, geometry and symmetry across physical platforms
2024-10-21	2024-10-25	Exact approaches to low-supersymmetry AdS/CFT
2024-11-11	2024-11-15	Murmurations in Arithmetic Geometry and Related Topics
2024-12-02	2024-12-06	Quantum information dynamics and non-equilibrium quantum matter
2024-12-16	2024-12-20	Energy Operators in Particle Physics, Quantum Field Theory and Gravity

2024-2025 Academic Year Workshops

2025-01-06	2025-01-10	Winter School: Boundary and Singularity in Fluid Mechanics
2025-02-10	2025-02-14	Recent developments in higher genus curve counting
2025-03-17	2025-03-21	Recent Developments on Mixing Times
2025-03-31	2025-04-04	Symplectic Singularities, Supersymmetric QFT, and Geometric Representation Theory
2025-04-07	2025-04-11	Hyperbolic & Dispersive Equations on Curved Geometries: Connections to Physics and General Relativity
2025-04-28	2025-05-02	Gauge Theory and Floer Homology in Low Dimensional Topology:
2025-06-02	2025-06-06	Black hole physics from strongly coupled thermal dynamics
2025-07-07	2025-07-25	3rd Simons Math Summer Workshop: Partial Differential Equations of Classical Physics

CENTER FOR ACCELERATOR SCIENCE AND EDUCATION

CASE
CENTER FOR ACCELERATOR SCIENCE AND EDUCATION

Ernest Courant Traineeship in Accelerator Science and Technology

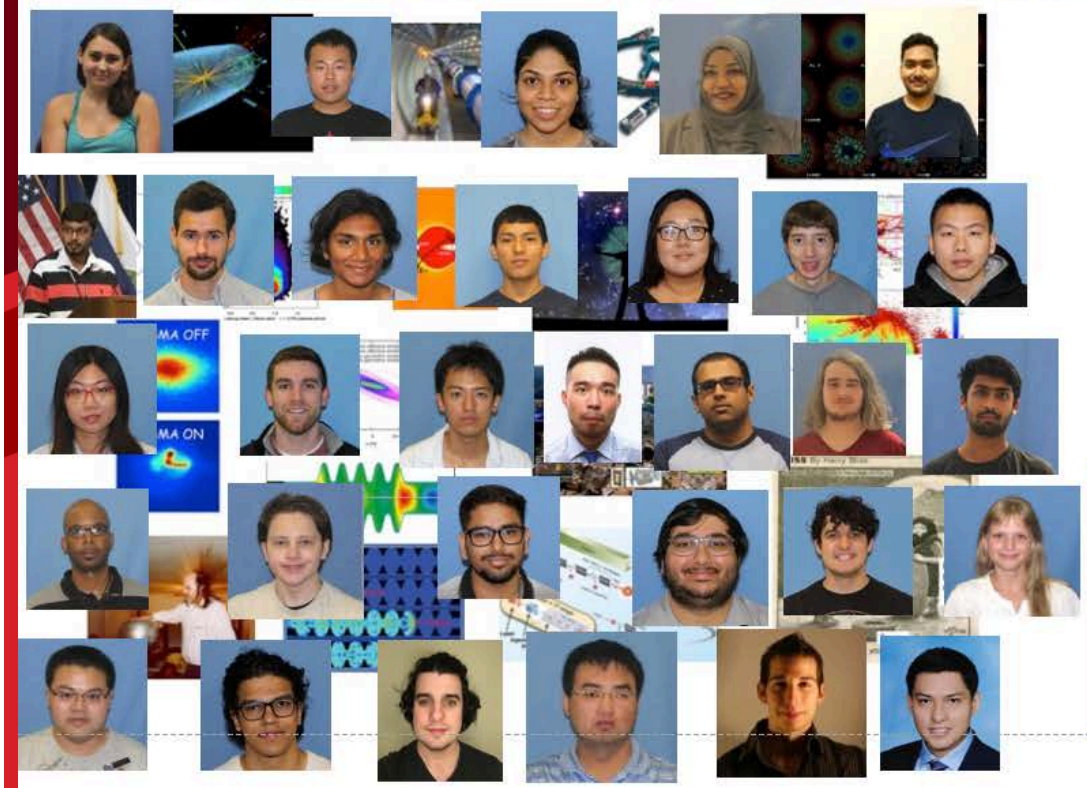
Renewed $3.7M traineeship award from the DOE HEP office. The program includes prestigious **"Certificate in Accelerator Science and Engineering"** and 2 years of support for qualified graduate students

https://www.stonybrook.edu/commcms/case

Vladimir Litvinenko

Navid Vafaei-Najafabadi

Prof. Vafaei-Najafabadi elected as chair of beamNetUS
accelerating beam-based research



Accelerator Physics research

EIC, Coherent electron Cooling, Polarized Gatling Gun, Super-conducting RF system, Laser-plasma accelerators, Future Colliders, Quantum Computing

CASE grants and awards exceeded $6M

New TT assistant Prof Search

Important publications:

Plasma electron acceleration driven by a long-wave-infrared laser, R. Zgadzaj, Nat. Commun, **15**, 4037 (2024)
Efficient numerical algorithm for multi-level ionization of high-atomic-number gases, A. Cheng, Phys. Plasmas **31**, 044503 (2024)
The science case for an intermediate energy advanced and novel accelerator linear collider facility, S.S. Bulanov, J. Inst **19** T01010 (2024)
Relations between Shot Noise, Gain Bandwidth, and Saturation of Instabilities, Y. Jing, , Physics, 6, 921, (2004)
3D theory of microscopic instabilities driven by space-charge forces, V. N. Litvinenko, Phys. Rev. Accel. Beams **26**, 054402 (2023)
Linear colliders based on laser-plasma accelerators, C.B. Schroeder, J. Inst **18** T06001 (2023)
Mapping the self-generated magnetic fields due to thermal Weibel instability, C.J. Zhang, Proc. Natl. Acad. Sci. U.S.A., 119 (50) e2211713119 (2022)

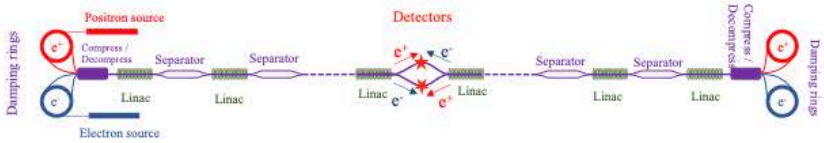
Main research projects

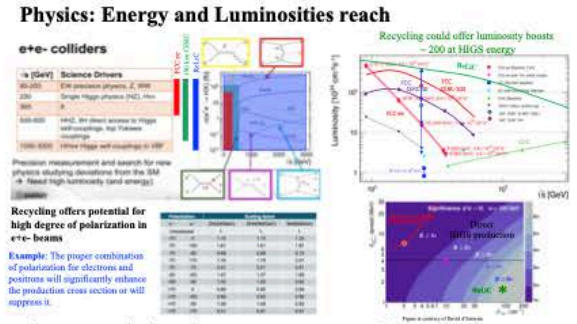
CASE
CENTER FOR ACCELERATOR SCIENCE AND EDUCATION

EIC & future colliders

- Coherent electron Cooling experiment at RHIC - demonstrating the process necessary for Electron Ion Collider to reach $10^{34}/(cm^2sec)$ luminosity

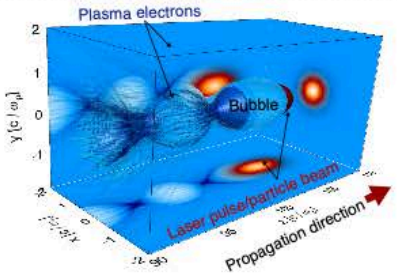
- Environmentally-friendly e^+e^- collider for Higgs and BSM physics with the c.m. energy and luminosity beating other competing proposals

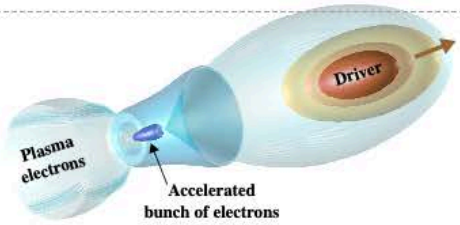




Wake-Field Accelerators

- Laser-driven plasma accelerator generated by ATF's unique high-power CO_2 laser
- Injection and acceleration sub-fs electron beams in particle-beam driven plasma waves
- Research relevant to laser-driven plasma fusion.





Stony Brook University

Join Us

CASE
CENTER FOR ACCELERATOR SCIENCE AND EDUCATION

- CASE offers outstanding research opportunities: plasma wakefield accelerators, generation of polarized and unpolarized high brightness beams, 21st century beam-cooling techniques, electron-ion collider at BNL and energy frontier e^+e^- collider, machine learning and ion-beam based quantum computers
- The Ernest Courant Traineeship offers support for qualified graduate students (currently seeking 3 MS and PhD students), and the opportunity of Certificate for highly sought-out specialties in Accelerator Sciences
- This semesters we are offering five courses ranging from Intro and Advanced Accelerator Physics to High Power RF and Cryogenic System engineering

Stony Brook University

The Laufer Center

The physics of biomolecules & cells

Ivet Bahar, Director, Biochem

Ken Dill, Physics (and Chem)

Carlos Simmerling, Chem

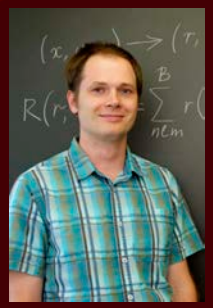
Lina Carlini, Biochem

Gabor Balazsi, BME

Eugene Serebryany, Physiology and Biophysics

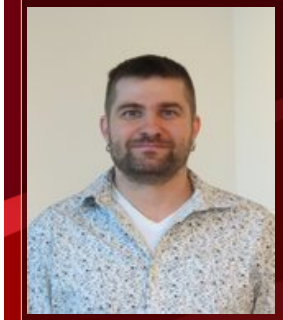
The Laufer Center

Affiliated Faculty












Dima Kozakov, Applied Math
Lily Mujica-Parodi, BME
Vageli Coutsias, Applied Math
Eric Brouzes, BME
Ramana Davuluri, Bioinformatics
Bruce Futcher, Microbiology
Helmut Strey, BME

David Green, Applied Math
Peter Koo, Cold Spring Harbor
Dan Raleigh, Chemistry
Rob Rizzo, Applied Math
Steve Skiena, Computer Science
Josh Rest, Evolution & Ecology
Jessica Seeliger, Pharmacology
Markus Seeliger, Pharmacology

Laufer Center questions

- *How do biomolecules achieve their functions?*

Physics & computing of biomolecules

Computer methods, forcefields, water physics, statistical mechanics of computing, drug discovery, molecular machines.

- *How do cells adapt to environments?*

Principles of homeostasis & evolution

Experiments & theory on cell fitness, noise & heterogeneity, drug resistance, non-genetic inheritance, metabolism & immunity.

- *How do networks make decisions?*

Principles of network flows & control

In biochemical pathways, in the brain, emergent properties across scales, systems & synthetic biology.

Laufer Center Physics News

Physics of the Origins of Life

PhD student Charles Kocher

Outstanding Theoretical Physics Thesis Award, 2024.

And, has the cover article in Proc Nat'l Acad Sci.

Publication: ***Nature Reviews Physics***

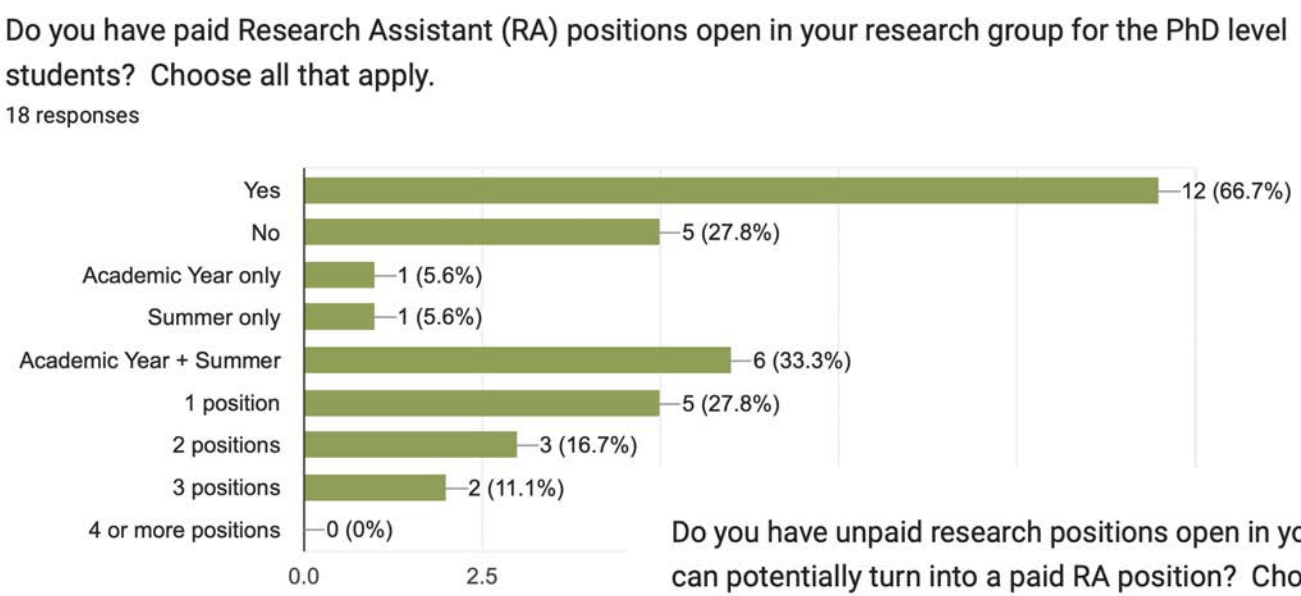
Ying-Jen Yang et al, Foundations of statistical physics & new insights into nonequilibrium theory.

Research Opportunities in SBU P&A Survey (26 responses so far)

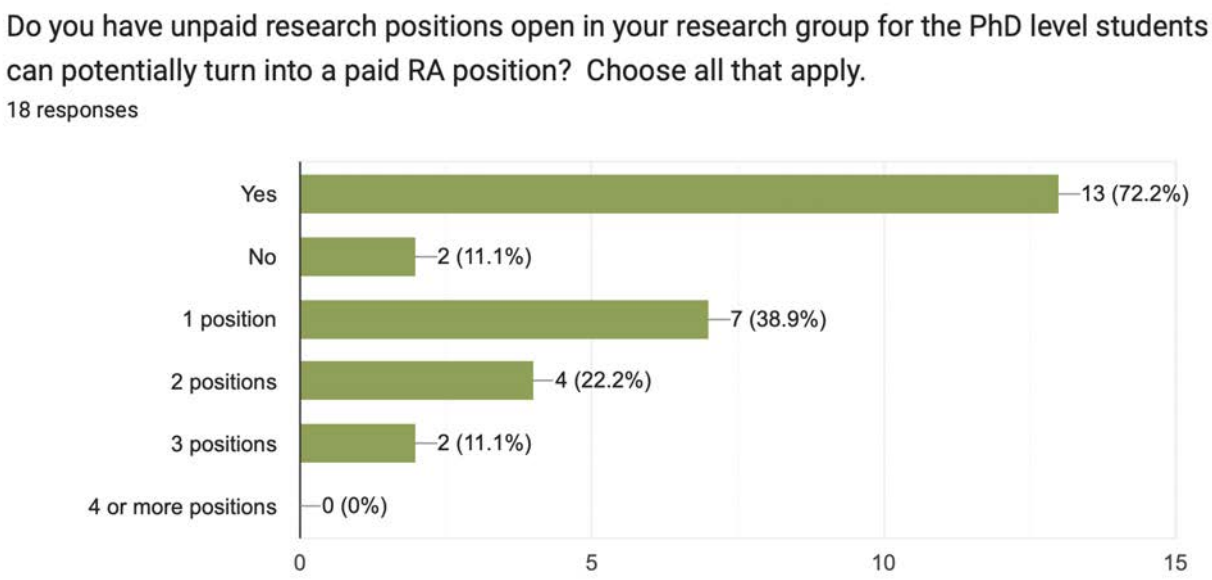
- Often, students do not know which professors have paid/unpaid research positions for Ph.D., MA and undergrad students
- Often, professors do not know how to reach students who might be interested in doing research with them
- Of course, they find each other in classes, by email, by knocking on the doors, through program directors, etc.
- This survey database is not meant to replace the above processes, but perhaps make the process of finding research advisor a bit easier
- The detailed survey results will be posted on the department website

Research Opportunities in SBU P&A Survey
(26 responses so far)

Paid RA positions for Ph.D. students

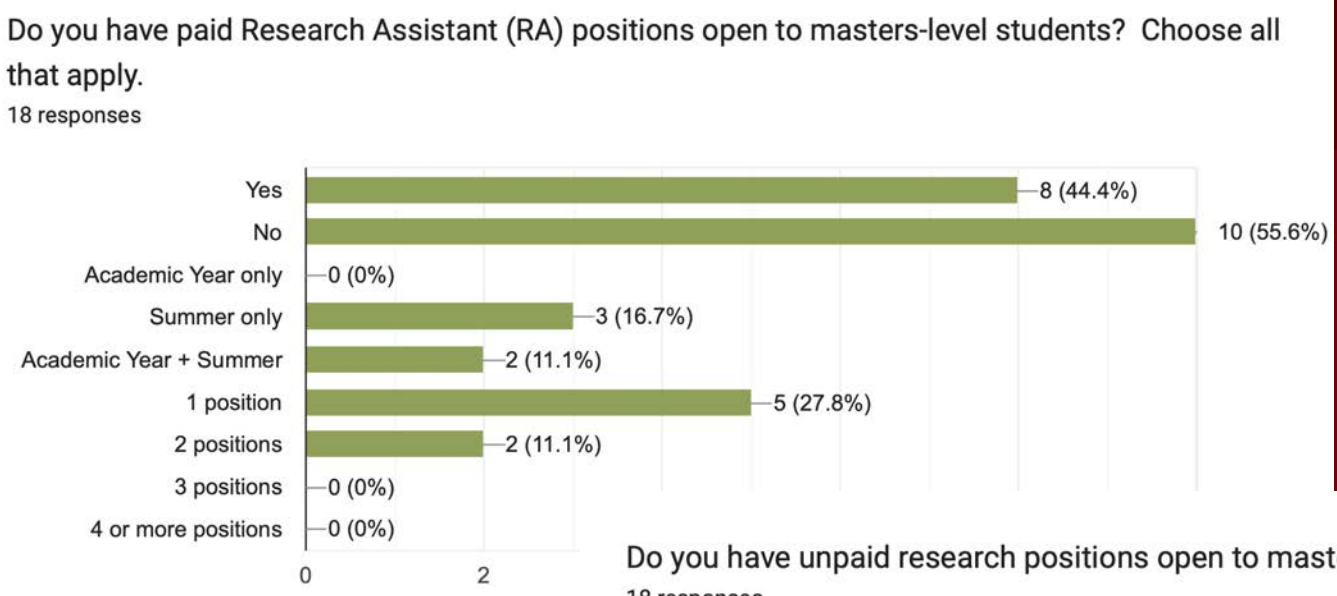


Unpaid research positions for Ph.D. students

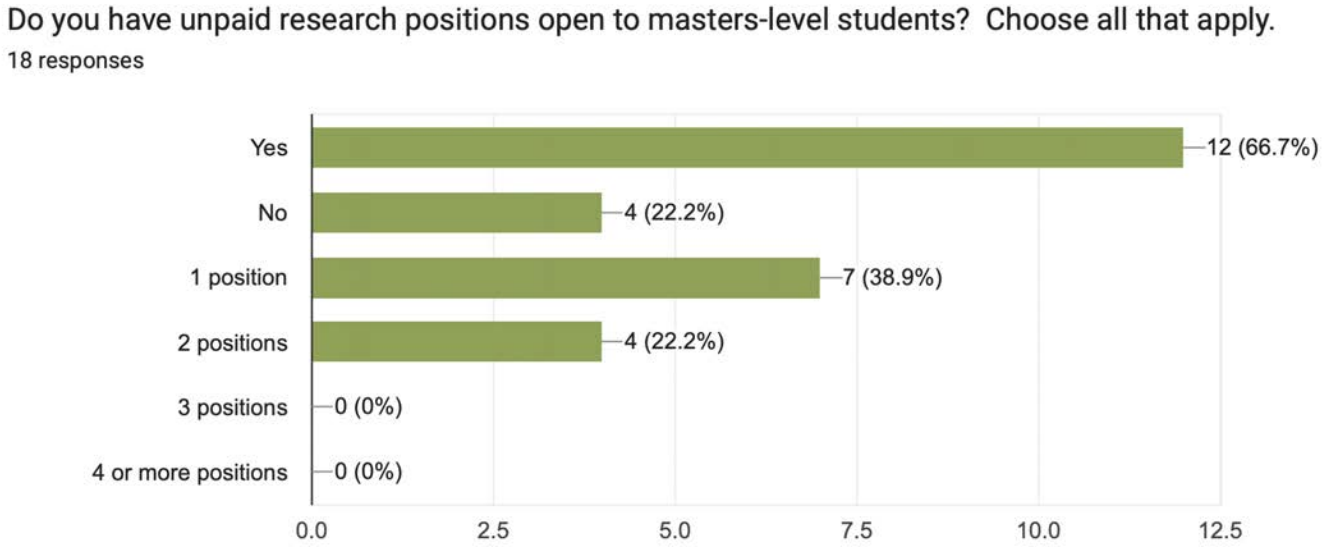


Research Opportunities in SBU P&A Survey (26 responses so far)

Paid RA positions for master program students

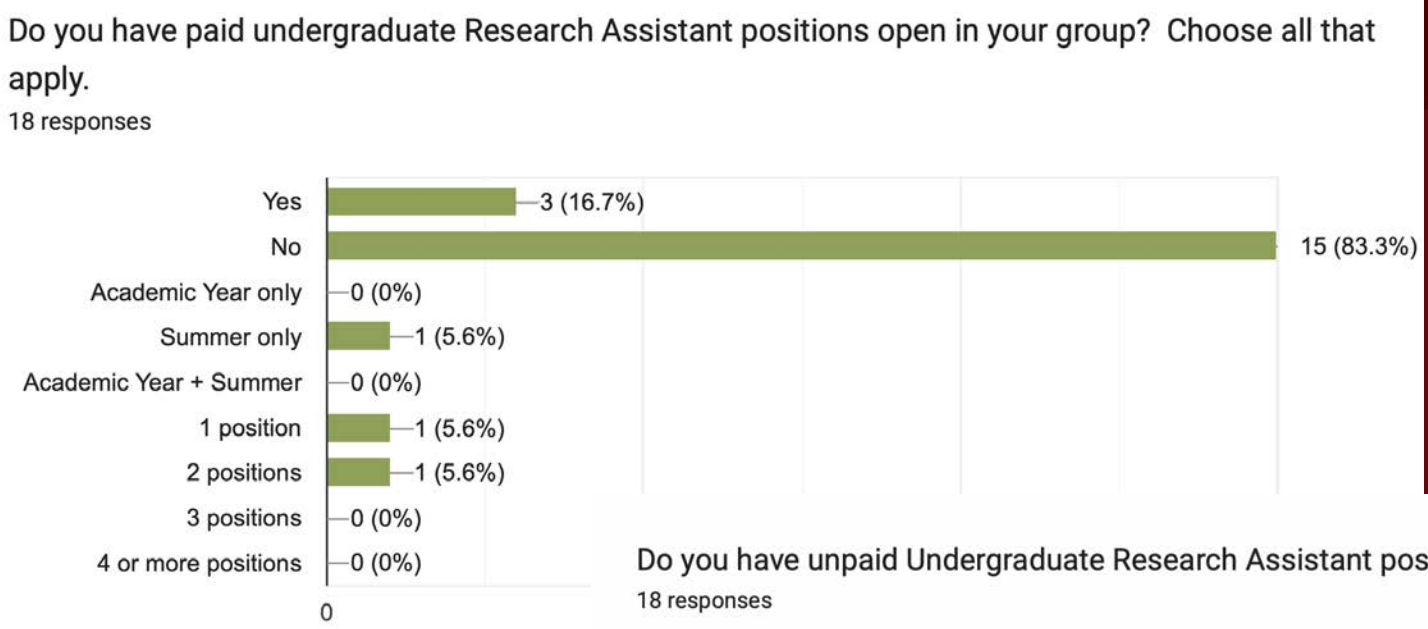


Unpaid research positions for master program students

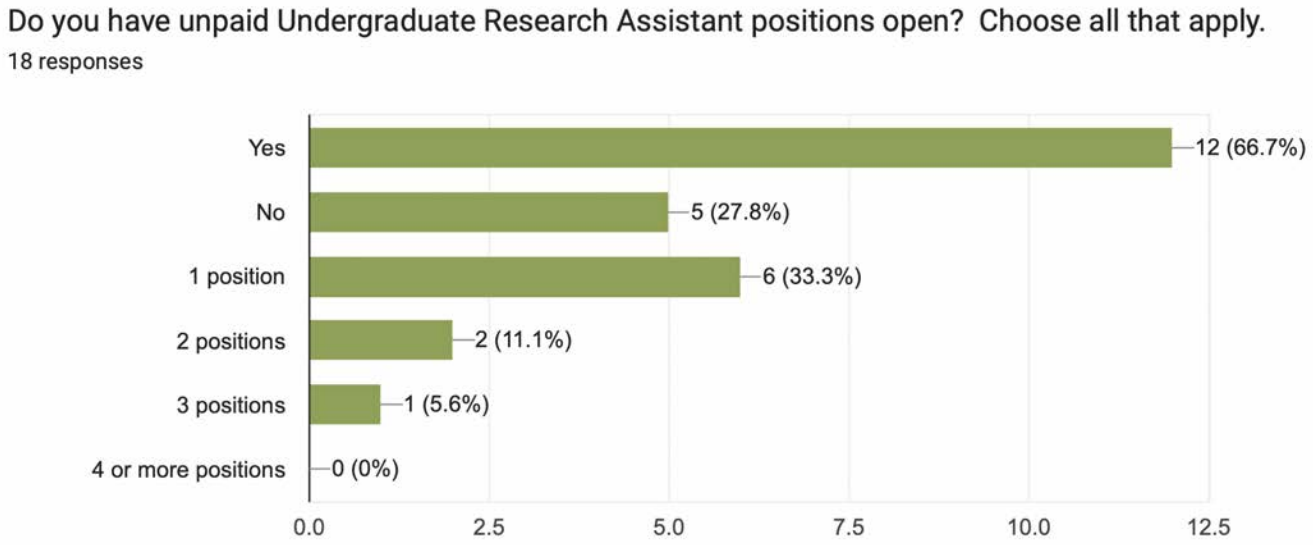


Research Opportunities in SBU P&A Survey (26 responses so far)

Paid RA positions for undergrads



Unpaid research positions for undergrads

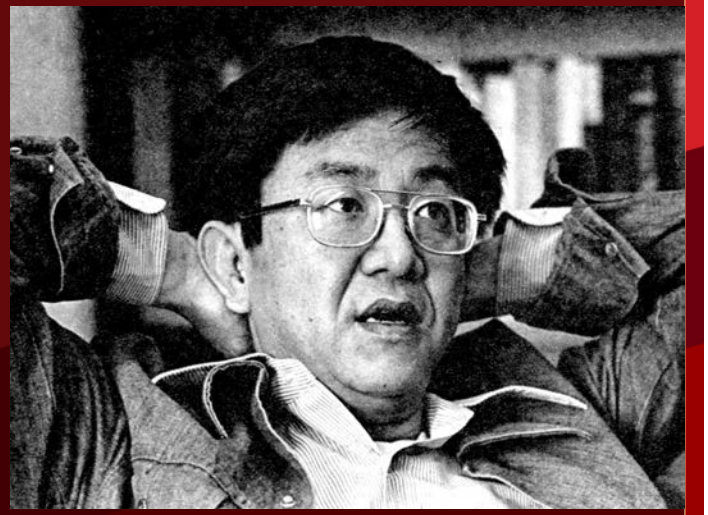


Research Opportunities in SBU P&A Survey (25 responses so far)

Partial view of the survey database

Last name, First name	Title	Do you have paid Research Assistant (RA) positions open in your research group for the PhD level students?	Do you have unpaid research positions open in your research group for the PhD level students that can potentially turn into a paid RA position?	Do you have paid Research Assistant (RA) positions open to masters-level students?	Do you have unpaid research positions open to masters-level students?	Do you have paid undergraduate Research Assistant positions open in your group?
Lattimer, James	tenured professor	Yes, Academic Year + Summer	Yes	No	Yes	No
Jung, Chang Kee	tenured professor	No	Yes, 1 position	No	Yes, 1 position	Yes, 2 positions
Perez Rios, Jesus	tenure-track assistant prc	No	1 position	No	1 position	No
Vladimir Litvinenko	tenured professor	Yes, 2 positions	Yes, 1 position	Yes, 1 position	No	No
Mengkun Liu	tenured associate profes:	1 position	2 positions	No	2 positions	No
Jiangyong Jia	tenured professor	Yes, 1 position	Yes, 1 position	Yes, Summer only, 1 posi	Yes, 1 position	No

Benjamin W. Lee (Ben Lee)



Ben Lee: in 1966, moved to SBU from Upenn; In 1973, moved to Fermilab to be the head of the Theory Group; In June 1977, tragically killed by an auto accident

→ Generally consider the best physicist with Korean ethnicity

Benjamin W. Lee (Ben Lee)

Peter vanNieuwenhuizen Aug 26, 2024, 9:04 PM (4 hours ago)

to me

Hi, Im have a nice short story about Ben Lee. He triggered the renormalization of the Standard Model by his lectures at Carge'se (in Corsica).

When still a student, 't Hooft (later Nobel) had applied to the summer school in les Houches, but was rejected. Instead he went to Cargese where Ben Lee (from Stony Brook) lectured on renormalization of theories with quarks and scalars, but not yet gauge fields. I was present when 't Hooft came back in Utrecht. He told to his adviser Veltman (Nobel) that he was interested in applying Ben Lee's methods to gauge theories. The rest is history. (Epilogue: after 't Hooft's and Veltman's stunning results on the renormalizability of the Standard Model, Ben Lee wrote with Jean Zinn Justin in Stony Brook several important papers working things further out).

Ben Lee's Main Contributions to Theoretical Particle Physics (by Robert Shrock)

Benjamin W. Lee made very important contributions to theoretical particle physics. Some of his main contributions were:

1. proof of the renormalizability of gauge theories with spontaneously broken gauge symmetry, which was crucial for the development of the standard theory ("standard model") of particle properties and interactions. This was complementary to the original proof by 't Hooft and contributions by Veltman.

2. analysis of dynamically broken chiral symmetry and of particle decays in hadronic physics

3. phenomenology of charmed particles, bound on charm quark mass

4. demonstration of suppression of weak strangeness-changing effects at the loop level in the standard model.

5. calculations of lepton family number violation in theories with massive neutrinos

6. constraints on heavy neutrino masses

7. analysis of Higgs phenomenology

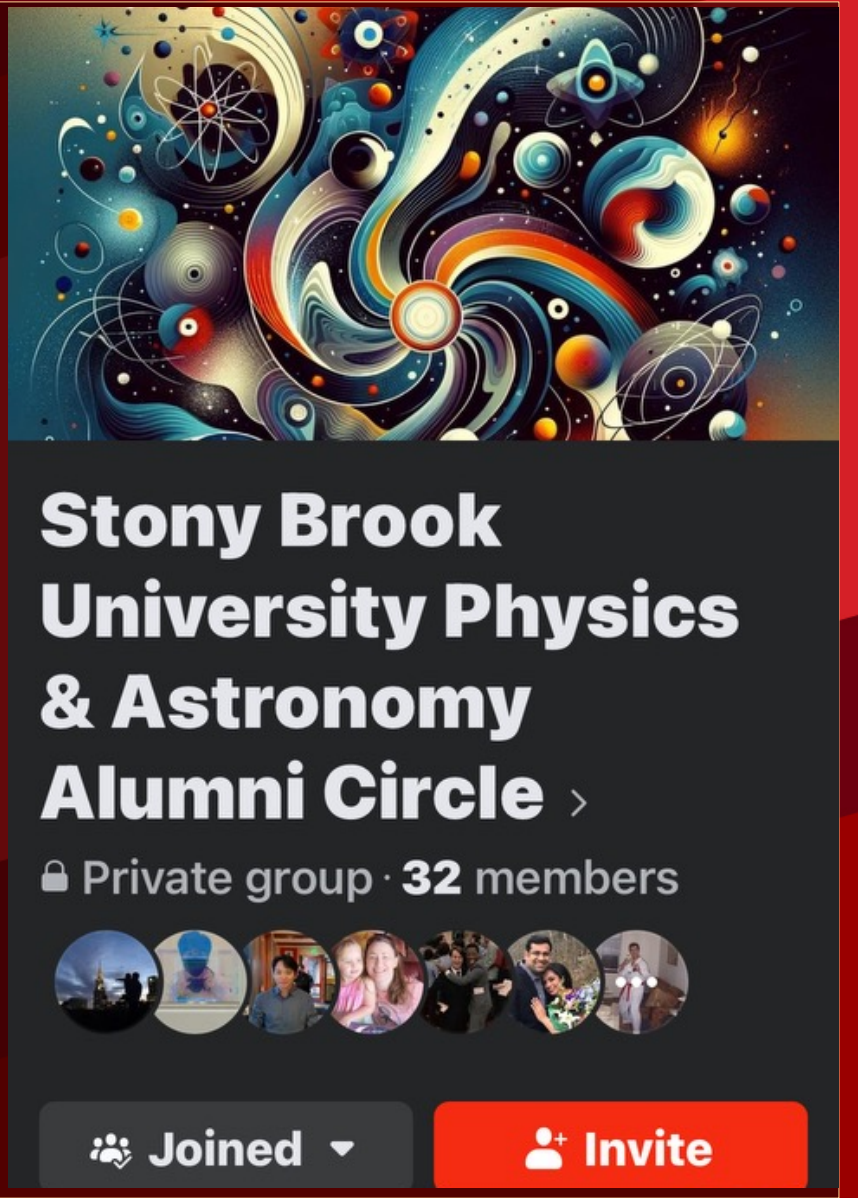
8. leadership of Fermilab theory group and recommendations for HEP program

While at Stony Brook, his collaborators included J. Zinn-Justin, W. Weisberger, and H.-T. Nieh;

while at Fermilab, his collaborators included W. Bardeen, M.K. Gaillard, R. Shrock, C. Quigg, S. Weinberg, and H. Thacker

Launching of P&A Alumni Circle

- Aim to create a long overdue bona fide P&A Alumni Group
- Membership
  - ¬ P&A faculty, staff, postdocs, grads and undergrads
- Informal inaugural meeting
  - ¬ Date: March 21, 2024
  - ¬ Location: in Manhattan
- Facebook Group and LinkedIN accounts
- Intererim Co-Chairs of the Executive Board
  - ¬ Tokufumi Kato
  - ¬ Giovanni Milione



The SBU P&A Alumni Circle Inaugural Event

Establishment of the Fumi and Hikaru Kato Endowed Fund for Excellence in Physics

Tokufumi (Fumi) Kato

- B.S. in 2001 from Stony Brook
- Ph.D. in 2007 from Stony Brook

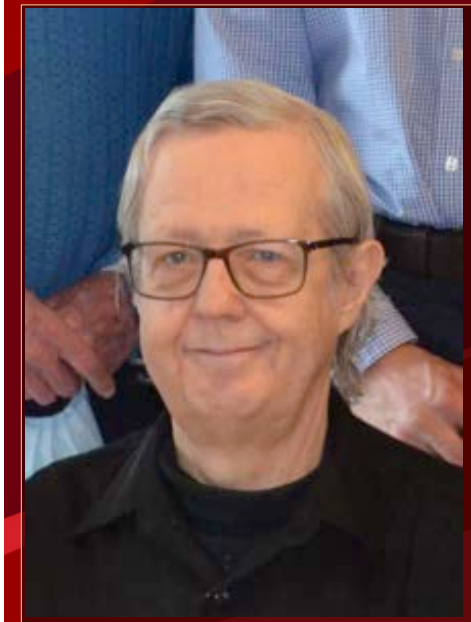
(worked on K2K and Super-Kamiokande experiments, advised by C.K. Jung)

- Currently, Senior Portfolio Manager Managing Director at Neuberger Berman Investment Firm

Building on his earlier initiative - the "Fumi Kato Student Excellence Fund in Physics," established in 2012 - Fumi seeks to extend and amplify its impact with this new fund

Endowment gift $100k + NYS matching funds $50k → a total impact of $150k to the department (another $150k to SBU from the Simons gift + NYS matching)

Establishment of the Robert "Dean" Schamberger Excellence Fund in Physics and Astronomy



Robert "Dean" Schamberger

- Enrolled in Stony Brook in 1966
- Both B.S. and Ph.D. from Stony Brook

(advised by Juliet Lee-Franzini)

- Currently Director of HEP Laboratories in the department
- Received 2023 SUNY Chancellor's Award for Excellence in Professional Service

Endowment gift $100k (same as Fumi's)

"Dean came to Stony Brook as an undergrad in 1960's and has never left. For essentially a half century, Dean has been a key member of the HEP group contributing to discoveries and scientific advances in experimental particle physics. He was the backbone of the group, and assisted and helped other group members tirelessly. More recently Dean has been working as de facto IT person for the department helping many people with various issues." - C. K. Jung

Change in the Department Web Czar

Alec Wills, Department Web Czar (2021-2024)

→ Played a critical role in major modernization of the department website

→ defended his Ph.D. thesis this year

→ took a position at the New York Academy of Science (NYAS) as "Program Manager, Awards (Physical Sciences & Engineering)"

Thank You, Alec!!!

Best Wishes!

Anthony Mannino, New Department Web Czar

Astro Wins the 3rd Chair's Cup Championship beating HEP at the 8-6 thriller final!

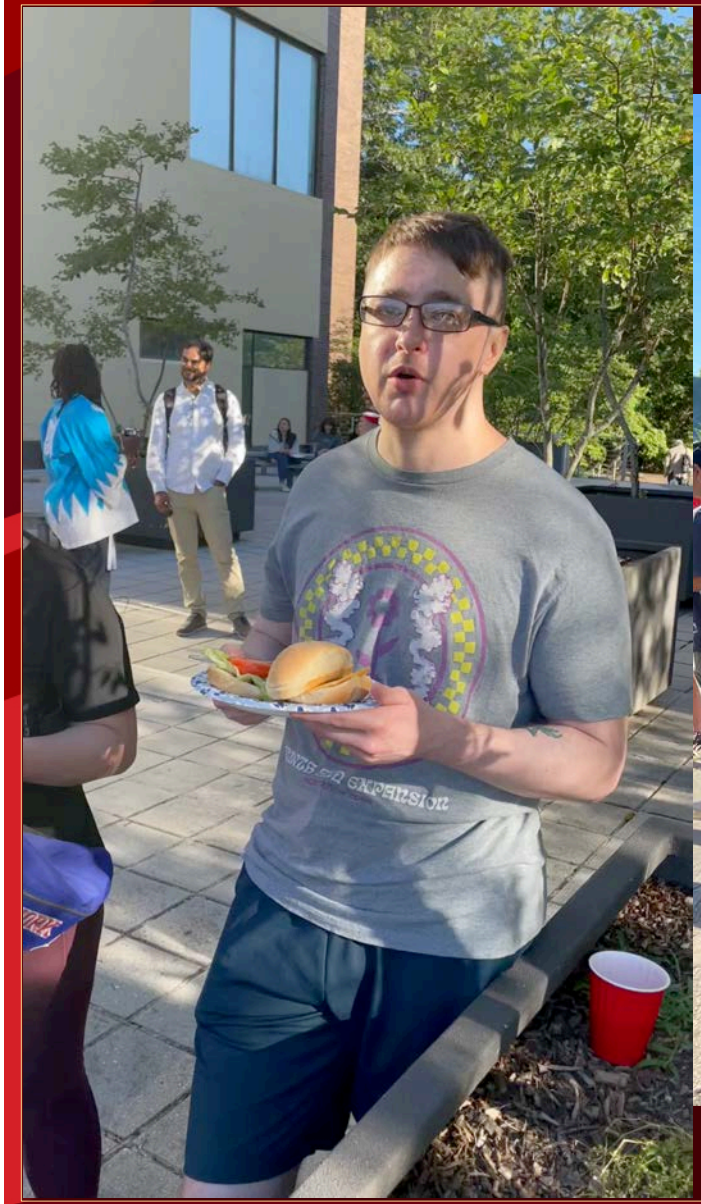
Tournament MVP: Simon Birrer

Department Summer Socials

- Accelerator Physics (AP)
- AMO
- Astronomy
- CM
- HEP
- NP-1 (CFNS)
- NP-2
- Physical Biology (Laufer)
- YITP
- SCGP
- BNL
- Chemistry

May 24 – First Social: PGSA+Chair
May 31 – No Social (Memorial Day)
June 7 – NP-1 (CFNS)
June 14 – YITP
June 21 – No Social
June 28 – **BNL (1st time in history)**
July 5 – No Social (4th of July)
July 12 – NP-2
July 19 – AP+Laufer Center
July 26 – AMO
August 2 – HEP
August 9 – Astronomy
August 16 – CM
August 23 – Last Social:PGSA+Chair

Friday BBQ Social Hosted by BNL



Department Picnic
West Meadow Beach









See you all at the P&A Department Picnic

Friday, Sep. 8, 5:00 pm

West Meadow Beach

The weather forecast looks good for now!

Thank you 🙏

The End