

A Collaborative Approach at Building Capacity in Space Weather at the Undergraduate Level



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**QUEENSBOROUGH COMMUNITY COLLEGE (QCC)
OF THE CITY UNIVERSITY OF NEW YORK (CUNY)**

**UN/USA WORKSHOP ON ISWI: THE DECADE AFTER IHY 2007
AUGUST 3, 2017**

The City University of New York (CUNY)



CUNY, located in New York City, is USA's largest urban public university. It provides high-quality, accessible education for more than **269,000 degree-credit students** and **247,000 adult, continuing and professional education students** at 24 campuses across New York City.

Excelsior Scholarship--Tuition at CUNY (\$5000)

The City University of New York (CUNY)



- ❖ 11 Senior Colleges
- ❖ 7 Community Colleges
- ❖ The Graduate School and University Center
- ❖ Macaulay Honors College
- ❖ CUNY Graduate School of Journalism
- ❖ CUNY School of Law at Queens College
- ❖ CUNY School of Professional Studies
- ❖ CUNY School of Public Health
- ❖ CUNY Medical School

The City University of New York (CUNY)



Community Colleges



“Community colleges.... are an American invention that put publicly funded higher education at close-to-home facilities, beginning nearly 100 years ago with Joliet Junior College...”

- ❖ 1,167 public and independent community colleges
- ❖ 1,600 when branch campuses are included.

American Association of Community Colleges
(AACCC,2015)

<http://www.aacc.nche.edu/>

Community Colleges



Community Colleges
(2-Yr)

e.g., (Engineering
Sciences majors)
Transfer to 4-Yr
(BS degree)

Workforce
(Re)training &
Life-long learning

Associate Degrees
(Technicians)

Graduate School
(Masters, Ph.D.
Professional Schools,
i.e., Law, Business,
Medicine, etc.)

Workforce

Workforce

Queensborough Community College (QCC)



Enrollment (as of Fall 2015): 15,493

Queensborough is located in one of the most diverse counties in the United States – Queens County, New York. The college comprises nearly equal populations of Blacks, Asians, Whites and Latinos, representing 139 nations of birth and 87 native languages.

People



- CUNY/QCC- Physics Department (M. Chantale Damas, **Paul Marchese, Tak Cheung & Raul Armendariz**)
- CUNY/City College of New York– Electrical Engineering Department and NOAA CREST (**Ahmed Mohamed**, Roger Dorsinville, Fred Moshary)
- CUNY/York- Physics Department (Kevin Lynch)
- NASA Goddard Space Flight Center—Community Coordinated Modeling Center (CCMC)--Masha Kuznetsova , Yihua Zheng, **Chigomezyo Ngwira**, Leila Mays, **Karin Muglach**, Antti Pulkinnen & CCMC Staff)
- Prince George’s Community College (Neeharika Thakur)
- University of Colorado at Boulder-- (Delores Knipp)

Students have access to a diverse group of mentors
RED=Scientific Collaborators

Students



Main criteria: Interest and Motivation

- Enrolled at Community Colleges
- At QCC- recruitment during 1st year
- Little to no background in physics- (first semester of Calculus-based physics)
- Diverse group
- Underrepresented population (minorities & women)

Funding



Main funding:

- 1. National Science Foundation (NSF) EAGER* (Geosciences Directorate; 2015-2017)**
- 2. NASA MUREP MC3I Program (2016-2019)**

Other sources:

- CUNY/Medgar Evers College NSF Research Experience for Undergraduates (REU) Program
- CUNY/QCC REU Program
- NASA New York Space Grant for Community College Partnership program
- The City of New York Mayor's Office--CUNY Research Scholars Program for Community College Students
- Department of Education MSEIP

*Early Concept Grants for Exploratory Research

QCC Space Weather Research Program



Main Goal

Design and implement an integrated research and education program in solar, geospace and atmospheric physics under the **umbrella discipline of space weather** for Community College (CC) Students.

Why Space Weather?



- Sounded cool & sexy
- Relevant to students because of technology
- NASA (still a great draw!)
- Tons of data
- Models that help with visualization
- Great way to teach physics without scaring students too much!

QCC Space Weather Research Program



A year-long research experience with two experiential learning opportunities:

1. During academic year, students are enrolled in a modified course-based introductory research experience (**CURE**) (**independent study**) where they learn the basics of space weather (1st semester) and gain research skills (2nd semester).
2. During the summer, students are placed in research internships at partner institutions
3. When they return from their summer experience in the fall semester, they continue with their research

Specific Objectives



1. Provide QCC students with research opportunities in space weather as early as their first year.
2. Develop educational materials in solar and atmospheric physics (space weather).
3. Introduce students to NASA-oriented research
4. Increase the number of students, especially underrepresented minorities, that transfer to 4-year STEM programs.
5. Incorporate evidenced-based practices that ensure project's success.

Course Undergraduate Research Experience (CURE)



Developed online materials/graphical user interface
Use: textbooks, lecture-tutorials, journal articles,
videos, etc.):

- ❖ Basic –intro to materials (can be used by non-science majors)
- ❖ Intermediate (include data analysis & intro to research)
- ❖ Advanced (covers material more in-depth, students choose research projects)

CURE



Course format:

- ❖ Students meet 3 to 6-hours/week as a class
- ❖ Students work independently and in groups
- ❖ Students meet individually with faculty mentors
- ❖ Lab rotation at City College of NY

In addition to receiving credit for doing research, students also receive a stipend (~\$500-750/semester)

Research Topics



Space weather effects on the magnetosphere, ionosphere and on ground, as well as their impact on technological systems.

1. Geomagnetic Storms (ICMEs/CIRs-Interplanetary Structures)
2. Geomagnetically Induced Currents (GICs)
3. Cosmic Rays
4. **Biological Systems (Fall 2017)**
5. NASA--student summer research topic (varies)

Data



1. Know where data come from (satellites)
2. Where to get data (NASA, NOAA, etc.)
3. Use of historical (archival) data & real-time
4. Data analysis using mainly MS EXCEL & Matlab
(statistical analysis, etc.)

Summer Internship Program



Students spend 10 weeks at partner institutions and get a \$5000 stipend (plus housing & transportation).

- ❖ NASA Goddard Space Flight Center
Community Coordinated Modeling Center
- ❖ QCC Space Weather Research Group
- ❖ City College of NY Smart grid Lab

NASA CCMC Space WREDI Bootcamp



- ❖ Students attend the 2-week space weather tutorials led by NASA Goddard scientists
- ❖ Fully funded

<https://ccmc.gsfc.nasa.gov/support/SWREDI/bootcamp/>

2015 Summer Research Internships



Opportunities (9 students):

- NASA/CCMC:
 - One research intern (QCC)
- QCC– 4 research interns
- CCNY Smart Grid Lab-- Two students interns (1 QCC, 1 CUNY/Hostos Community College)

2015 Student Published Abstracts



Characterizing Interplanetary Structures of Long- Lasting Ionospheric Storm Events (AGU)

Christopher Tandoi*, Chigomyezo Ngwira, M. Chantale Damas. (2015).

***Dst Profile Investigation with Gamma Distribution and Diffusion-Like Distribution* (AMS)**

M. Chantale Damas, Ying Dong*, San Peng*, Zhenkang Yang*, Tak Cheung. (2016).

Modeling the Impacts of Geomagnetic Disturbances on the New York State Power Transmission System (AGU)

Djibrina Ouedraogo*, Orlando Castillo*, Ahmed Mohamed, M. Chantale Damas, Chigomyezo Ngwira.

¹ QCC Undergraduate Students; ²CCNY Graduate Student

2016 Summer Research Internships



Opportunities (9 students):

- NASA/CCMC:
 - Two Forecasting interns (QCC)
 - Two Research interns (QCC)
- QCC– One research intern
- CCNY Smart Grid Lab-- Four students interns (QCC) (3 QCC, 1 City College)

2016 Published Abstracts



Abstracts Submitted to AGU :

Using Flow Charts to Visualize the Decision Process in Space Weather Forecasting

Myo Thu Ya Aung¹, Tun Myat¹, Yihua Zheng, M.Leila Mays, Chigomezyo M. Ngwira, M. Chantale Damas

Comparing the Characteristics of Ionosphere for Different Solar Minimum Periods

Sylvanus Bawie¹, Chigomyezo M. Ngwira, M. Chantale Damas Damas

Characterizing the Interplanetary Structures of Long-Lasting Storms: Fitting Dst Profile with Gamma Distribution and Diffusion-Like Distribution

Ying Dong¹, Jason Chou¹, M. Chantale Damas, Tak Cheung

Space Weather Effects on Current and Future Electric Power Systems

Oindrilla Dutta², Chris Tandoi¹, Ahmed Mohamed, Werner Brandauer, M.Chantale Damas

¹ QCC Undergraduate Students; ²CCNY Graduate Student

2017 Summer Research Internships



Opportunities:

- NASA/CCMC: (5 research scientists & CCMC team)
 - 5 Research interns (4 CUNY; 2 other)
 - 2 Forecasting interns (2 other)
- CUNY: (3 QCC faculty; 1 York)
 - 3 QCC Research interns
 - 1 at Brookhaven National Laboratory (BNL)
 - 1 at CUNY York College

2017 Abstracts submitted to AGU



Summer (2017): 7 abstracts submitted to AGU (10 students):

- Is the Solar Magnetic Field Getting Weaker? (1)
- An Investigation of Interplanetary Structures for Solar Cycles 23 and 24 and their Space Weather Consequences. (2)
- Quantifying Temporal and Spatial -Characteristics of Pulsating Aurora. (1)
- Study of Geomagnetic Field Response to Solar Wind Forcing. (2)
- Validation of the Kp Geomagnetic Index Forecast at CCMC (1)
- The Magnetic Evolution of Coronal Hole Bright Points. (1)
- Inverse Flux versus Pressure of Muons from Cosmic Rays. (1)

Follow-up for transfer students



Two students were interns at the University of Michigan Engineering Summer Research Opportunity Program (SROP):
(First internship at NASA Goddard)

Projects:

-Origami-Inspired Rapidly Deployable Structure with Multiple Compartments

Myo Thu Ya Aung* & Evgueni Filipov

Building and Launching a Nano Spacecraft.

Danny Munoz* & Bryan Gilchrist

*QCC students

Outcomes



1. Research skills
2. Communication skills (oral, written)
 1. Abstract, scientific paper, ppt presentation (oral), poster
3. Computer skills (programming-Python, C++, Matlab, etc.)
4. How to critique each other's work
5. Attend and present at a scientific meeting
6. Part of a community—support, help and mentor each other

Challenges



- Preparedness of students (math & science skills) (e.g., students have not had E&M or are just taking the first semester of calculus-based physics.
- Have students for only one or two years.
- Resources: access to publications, etc.
- Time: heavy teaching load (4-5 courses/semester) plus research and committee work
- Funds to travel and pay students (always writing grants!!)
- Look for and foster research collaboration

Challenges



- Research projects that are manageable & at proper level, yet challenging for CC students
- Competition for students' time (courses, work, clubs, etc.)
- **Sustainability (Can we continue without the money? YES and NO)**

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Web page



https://qcc-cuny.digication.com/solar_and_atmospheric_physics_research_group/Home1/preview

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