How NASA Astrophysics Transformed an HBCU:
*University of the Virgin Islands*

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University of the Virgin Islands
College of Science and Mathematics
Department of Chemical and Physical Sciences

237 Meeting of the American Astronomical Society
Special Session: Enhancing Participation of Minority Serving Institutions in NASA Space Science
January 11, 2021
Outline

• Historical Background on Astronomy at UVI and Early NASA Involvement with Etelman Observatory

• Etelman Observatory VIRT and Recent Science Milestones

• Development of Broader NASA Activities at UVI and the UVI Physics B.S. Degree

• The NASA Impact at UVI
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UVI physics grew from 2 faculty (2012). ..

David Morris (UVI):  
**Role:** Physics Asst Professor; Observatory Director

Dave Smith (UVI):  
**Role:** Physics Professor; Physics AS lead
..to a physics research group (2016)..

David Morris (UVI):
**Role:** Physics program lead; Observatory Director

Jan Staff (UVI):
**Role:** Physics Asst Professor

Dave Smith (UVI-retired):
**Role:** Physics Professor

Nino Cucchiara (Marin College):
**Role:** Physics Asst Professor

Brice Orange (OWIS):
**Role:** Observatory Operations Manager

Bruce Gendre (UWA):
**Role:** VIRT resident astronomer
David Morris (UVI): Role: Physics program lead; Observatory Director

Jan Staff (UVI): Role: Physics Asst Professor

Lev Horodyskyj (UVI): Role: Physics Asst Professor

Nino Cucchiara (Marin College): Role: Physics Asst Professor

Dave Smith (UVI-retired): Role: Physics Professor

Dario Carbone (UVI): Role: Physics Asst Professor

Michael Henry (UVI): Role: Physics Asst Professor

Jonisha Aubain (UVI): Role: UVI Adjunct Physics Instructor

Brice Orange (OWIS): Role: Observatory Operations Manager

Priya Gokuldas (UVI): Role: VIRT Resident Observer


Orpha Penn (UVI): Role: Physics Grants Manager

..to a NASA Astrophysics Team (2020)
The University of the Virgin Islands

- Located at the border between the Caribbean sea and the Atlantic Ocean
- HBCU Founded in 1962 (as CVI: 2-yr school)
- Campuses on St. Thomas and St. Croix
- ~2300 students
- Primarily USVI students (75%) with some US mainland and other Caribbean nationals
- Traditional majors of nursing, business, biology; recently engineering and physical science
Astronomy established at UVI through donation of Etelman Observatory (1967)
Opportunity in ~2000 to fill “gap” in world-wide follow-up of transients – particularly Swift
But personnel turnover and technical challenges constrained progress in the 2000’s
College of Charleston maintains facility almost exclusively from abroad in late 2000’s
Post-2000 Renovation: 
Etelman Observatory Science Center
VIRT Installation: 2003
Reopening to USVI Public: June 2012
Diversity in Physics Education

The number of physics degrees in the US is at its highest level ever

But physics degrees earned by underrepresented students is falling
Diversity in STEM Careers

Minorities in STEM Careers by field (NSF National Center for Science and Engineering Statistics - NCSES)

Women in STEM Careers by field (NSF National Center for Science and Engineering Statistics - NCSES)
Enter the UVI Physics Initiative

- Drive to educate a new generation of USVI students in physics and engineering disciplines
- VIRT is a central research facility
- Developing pipeline of students from local schools through UVI and beyond to grad-school/employment
- UVI-physics students do research throughout their academic career at UVI
- Opportunities on St. Thomas as well as with partners (NASA-GSFC, Smithsonian Institute (DC), Harvard-SAO, DoD, UAH, UTA, UMD, UWM, UCB, UwA)
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VIRT Instrumentation c. 2017

- OMI 0.5m f/10 Cassegrain telescope design
- FLI-IMG4240 camera upgraded into new PL4240 camera body (60s → 1s readout improvement)
  - 20’x20’ FOV
  - 0.5” pixels
  - 2048X2048
  - Back-illuminated
- FLI-CW3-12 12-position filter wheel (currently UBVRI-clear)
- Boltwood II Cloud Sensor
- Davis Vantage Pro II weather sensor
- CSIMC-card control of all axes
We observed the field of GRB 170202A (Racusin et al. GCN 20575) with the 0.5m Virgin Island Robotic Telescope (VIRT) on February the 3rd, starting at 3:16 UT (8.8 hours after the trigger), until 10:30 UT. We performed a series of exposures in the clear filter. The weather conditions were variable with a typical estimated seeing of 2".

We detected the afterglow observed by UVOT (Racusin et al., GCN 20575) on a combined image (spanning times from 10h to 11.92h after the trigger). Its magnitude, estimated by comparison to nearby USNO-B1 stars, was $R = 20.8 +/- 0.3$.

Further analysis is in progress. Magnitudes have not been corrected for Galactic extinction. The VIRT is still in its commissioning phase. This message can be cited.
Impact of new personnel – on science

Prior to 2015, the Observatory had always been operated by a single astronomer who also was a full-time teaching faculty at UVI

2015/02 Observatory manager/Software Scientist hired

2015/04 Resident Astronomer/Robotization Scientist hired

2016/09 Two additional GRB researchers hired

*MUREP-funded*
Prior to 2015, the Observatory had always been operated by a single astronomer who also was a full-time teaching faculty at UVI.

- **2015/02** Observatory manager/Software Scientist hired
- **2015/04** Resident Astronomer/Robotization Scientist hired
- **2016/09** Two additional GRB researchers hired

MUREP-funded

x50 increase in science data from pre-MUREP
Summary of GRB follow 2019-present

- 5 GRB detections and 15 upper limits reported in 20 months
- See iposters 135.01 Gokuldass et. al. and 139.02 Orange et. al.
Participants in GW170817 Follow-up

ESO – LIGO-Virgo Collaboration
Participants in GW170817 Follow-up

[Map of the world showing locations of LIGO Hanford, LIGO Livingston, and Virgo.]
Participants in GW170817 Follow-up

Andreoni et al., 2017
Participants in GW170817 Follow-up

Andreoni et al., 2017
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2017 Astrophysics Conferences at UVI

Generation-GW: Diving Into Gravitational Waves
June 5-9, 2017

Unveiling the Physics Behind Extreme AGN Variability
July 10-14, 2017
Vacuum chamber assembly - 2016

- From student sketch to functioning ultra-high vacuum chamber in 2 years
Vacuum chamber assembly - 2016

- First high/ultrahigh vacuum achieved in the USVI on July 12, 2016
- Ultimate pressure of $8.9 \times 10^{-7}$ mbar reached on Sept 2, 2016
Vacuum lab upgrades for UVI-GREAT - 2018

• Chamber moved to new dedicated lab space in May 2017

• New UVI-GREAT cubesat project started 2018

• 3d-printer added to lab for rapid prototyping

• MEGAlib Simulations in support of UVI-GREAT cubesat design (2018)
Vacuum lab upgrades for UVI-GREAT - 2018

- Detector characterization ongoing at GSFC and in UVI lab in parallel

- Printer used in 2020 for COVID19 personal protective equipment production

- Distributed ~250 masks and ~100 faceshields to first responders and UVI personnel
Lots and lots of outreach

Public Observing at Etelman Obs

Starlab Planetarium Events

STARS Amateur Astronomy Club

K-12 Astro Clubs

NSBP Annual Meeting
Farewell 2017 Great American Eclipse
Easternmost Observing Point in the US
NASA Ed&Outreach Visits to USVI

2016

2017

2019
The First Three Impactors

- May 17, 2019, Azhar Hussein, Jonisha Aubain, and Matthew Fortenberry became first graduating class of physics B.S. students from the University of the Virgin Islands

- In 2017 only 3 HBCUs graduated more than 3 physics BS students: Morehouse, Texas Southern, and Xavier University of Louisiana (avg cost $30k/yr)
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<table>
<thead>
<tr>
<th>Year</th>
<th>Institutions</th>
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<tbody>
<tr>
<td>2015</td>
<td>NASA Goddard, University of California, Los Angeles, University of Florida</td>
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The Second Three Impactors

- On May 14th, 2020, Orian Stapleton and Peter Jean-Baptiste became the second graduating class of physics bachelor of science students from the UVI.
- Chemistry major and Physics A.S. student Fatimah Hussein also graduated in 2020 and is pursuing a PhD in AstroChemistry

- Six students planning to graduate in the UVI class of 2021

Orian Stapleton  
MIT  
Whitehead Institute  
Bioinformatics Technician

Peter Jean-Baptiste  
UVI  
VIVIaN lab  
Lead Instrument Technician

Fatimah Hussein  
University of Virginia  
AstroChemistry  
Bridge-to-PhD Program
Impact – Addressing Diversity and Inclusion in STEM

Careers One Physicist at a Time

graduates
majors

2018 2019 2020 2021

0 2 4 6 8 10 12 14 16


Engineering Computer sciences and mathematics Physical sciences Life sciences Psychology and social sciences


Engineering Computer sciences and mathematics Physical sciences Life sciences Psychology and social sciences

Thousands Percent share

0 200 400 600 800 1,000

90 70 50 30 10

0 20 40 60 80 100

0 25 20 15 10 5