Almost 2 Decades of Education/Public Outreach with Chicago Public Schools

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Context

- I am a Research Professor in Astronomy and Astrophysics at the University of Chicago.
- I have also been involved in Education and Public Outreach (E/PO) throughout my career.
- I want to highlight here work done mainly with Chicago Public Schools (CPS). This includes a very diverse set of students.

Multiwavelength Astronomy

- Project funded by 3 NASA E/PO grants (PI Don York). Lasted several years.
- Geared towards developing modules for the individual wavelength regimes comprising the electromagnetic spectrum, training teachers to use the resource and deploying it in Chicago Public schools.
- The first grant supported optical, infra-red and ultraviolet astronomy. The second was aimed at X-ray and gamma-ray astronomy.
- We finished with a program aimed at developing teachers' in-depth content area knowledge, pedagogical training for science inquiry, providing state-of-the-art learning opportunities for astronomical inquiry, and ongoing mentoring.
- I was a Co-I on the X-ray/Gamma-Ray grant, and subject matter expert on the third grant.

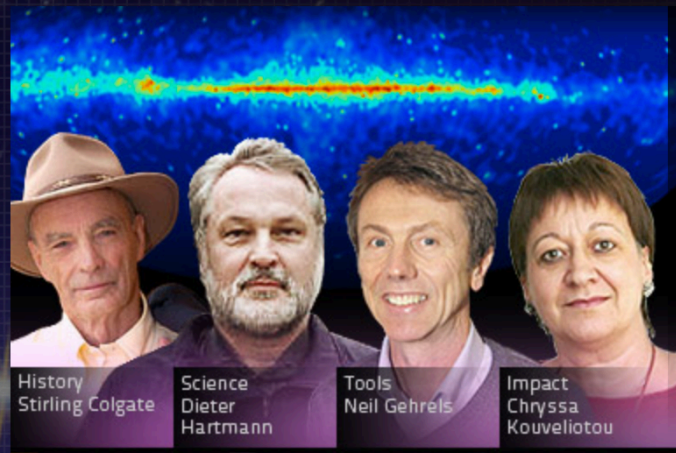
Multiwavelength Astronomy Website

- One outcome of our work was the "Multiwavelength Astronomy" website.
- The content of each lesson was derived from interviews with scientists, archived oral histories, and/or memoirs.
- Lessons were evaluated by a science educator and at least one external subject matter expert before being produced for the web.
- They are supplemented by NASA media; archival material from the University of Chicago Library; and participant contributed photographs, light curves, and spectra.

- This can be accessed at: http://ecuip.lib.uchicago.edu/multiwavelength-astronomy/

Multiwavelength Astronomy

Learn about multiwavelength astronomy from leaders in the field.



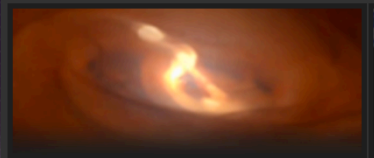
Gamma Ray Astronomy

Study the physics of the Universe at its most extreme. Follow scientists unraveling the mysteries massive stars that end their lives as Gamma Ray Bursts.

read more »

Infrared Astronomy | Optical Astronomy | Ultraviolet Astronomy | X-Ray Astronomy | Gamma Ray Astronomy

Astrophysics Overview



Forces of Nature

Learn how the four fundamental forces of nature come together to shape glaxaies, stars, and planets from clouds of swirling dust

Telescope Design

The challenge for creating multiwavelength telescopes is finding the best materials and methods to focus and detect light

Spectroscopy

Get an animated overview of how a spectrograph works, and see how spectra in each waveband help astrophysicists turn light

Multimedia Library

Search and browse all images and videos »

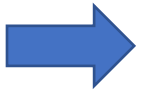
Multiwavelength Connections

The Swift Gamma-Ray Burst Mission: A Decade of Game-Changing Astrophysics

Learn how Swift takes a multiwavelength approach to probing the high energy Universe. WATCH VIDEO »

Gamma-Ray Module

- The history of the field is covered by Stirling Colgate. Stirling as always had interesting stories to tell, not only involving supernovae and gamma-rays but also how he contributed to peace efforts with Russia.
- These are the kind of stories that students are always fascinated to hear.
- An introduction to gamma-ray science is clearly given by Dieter Hartmann.
- The development of tools to understand gamma-rays, and how the field advanced, was expertly written by Neil Gehrels, PI of Swift.
- The impact of gamma-ray astronomy was impressively outlined by Chryssa Kouveliotou.
- This module puts a lot of emphasis on gamma-ray bursts and related phenomena, which were being heavily studied when the content was being created.
- The lives of the various astrophysicists, and the different paths they took to reach their current status, were all appreciated by the students as much as the science that they were introduced to.
- Students got to talk to some of these experts live during the summer programs, and loved it.



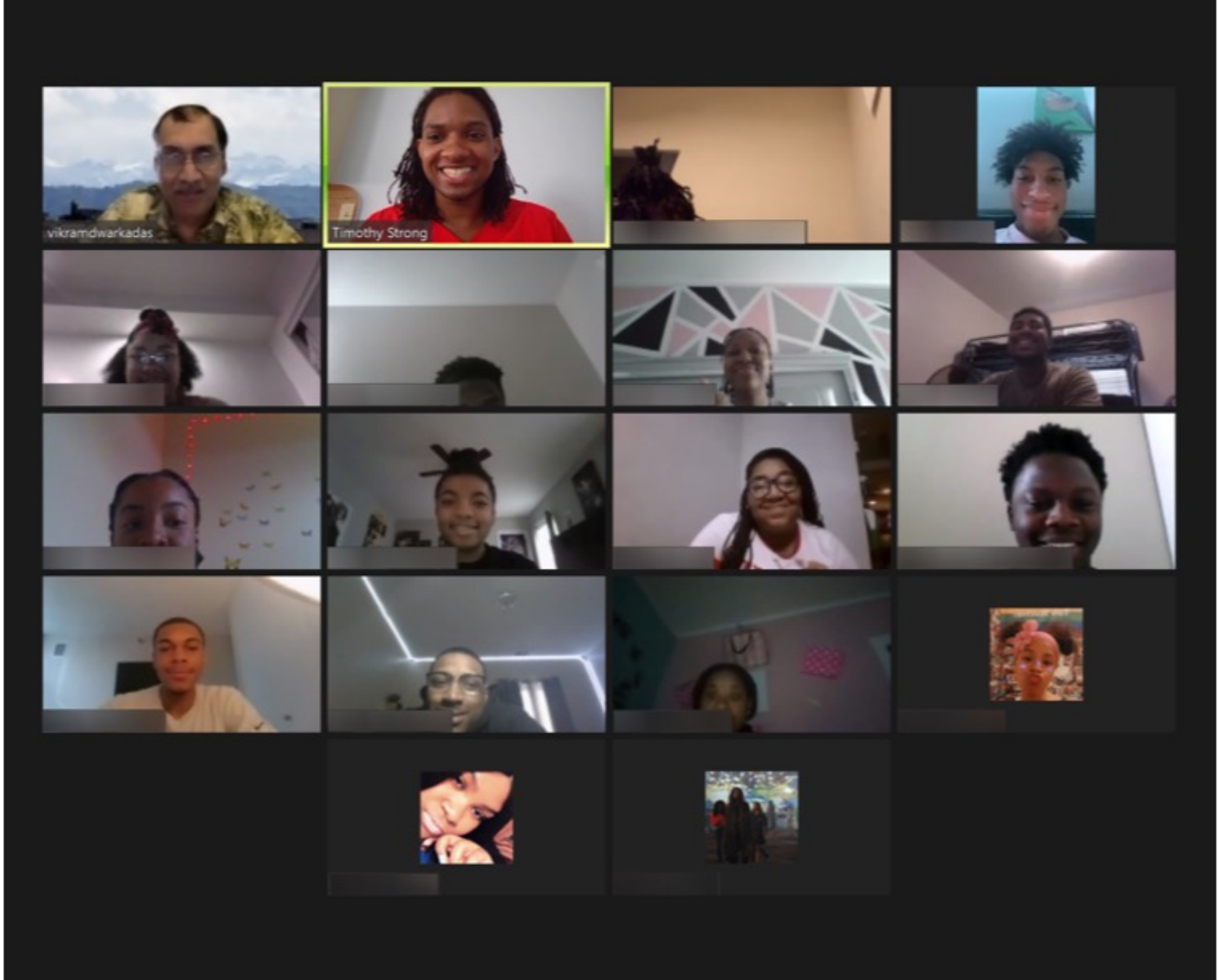
One lesson is that the history, and the people, are as fascinating as the science.

NASA E/PO Summer Programs

- A 2-3 week summer program was held, involving CPS teachers and some of their students.
- Training was provided to the teachers and the students.
- They were introduced to the lessons and trained in astronomy at various wavelengths.
- The students were invited to participate so that the effectiveness of the lessons could be gauged in practice.
- Budget included a computation device (Ipad Mini, 10” computer) that participants could use and keep.

CHARM-Chicago Area Research Mentoring
(funded by NSF)

- In 2020-2021, I was working with high-school Physics teacher Mr. Timothy Strong at the University of Chicago Charter School, Woodlawn.
- I delivered lectures in astronomy to his 11^{th} grade honors class about every month.
- There were 17 honors students, all in the top 10% of their class.



A (zoom) group photo, taken by the class teacher Mr. Strong, showing him, some of his students, and me, in the grade 11 Physics honors class that I was teaching during the past academic year at the UC Woodlawn school, Chicago. Reproduced with permission granted by Mr. Strong.

CHARM (contd)

- The lectures were on various topics, mainly dealing with massive stars and supernovae. Shocks in supernovae, and sonic booms, were discussed. Particle acceleration at shocks, and cosmic rays, was planned, but due to the remote nature and the small class time (35 mins) we did not get as much accomplished.
- At the end of the year, one student was to be selected to carry out a 1-month summer research internship under my supervision at University of Chicago.
- Unfortunately, the pandemic did not allow this to happen.
- The program will be continued in 2021-2022.

Lessons Learned

- It is important to engage students in STEM topics from a young age. It is necessary to use age-appropriate content and pedagogy.
- Multiwavelength astronomy is not generally taught at the middle school and high school levels, but there's no reason why it cannot be. This is specifically why we created the multiwavelength astronomy website. It is designed for middle and high schoolers.
- Training teachers to teach astronomy in their classrooms helps astronomers to disseminate knowledge and broaden outreach efforts.
- Assessing the effectiveness of educational materials is important. Assessment can be informal, via conversations with teachers and students, and via student blogs. Formal assessment can be accomplished through evaluators, science educators and subject matter experts.
- Funding is required for extensive outreach efforts at the K-12 level.
- Scientists need to personally talk to, teach, and encourage young minds.
- Students love learning about scientists themselves, and the path to scientific discoveries, in addition to the science. Tell them stories about the people behind the science.

Questions and Discussion

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