Marcel Agüeros is a Puerto Rican professor of astronomy at Columbia University working in stellar astrophysics. He uses observations of low-mass stars to calibrate the relationship between their age, rotation and magnetic activity. He has made significant contributions to understanding the **life cycles of stars**, **star clusters**, and **binary star systems**.

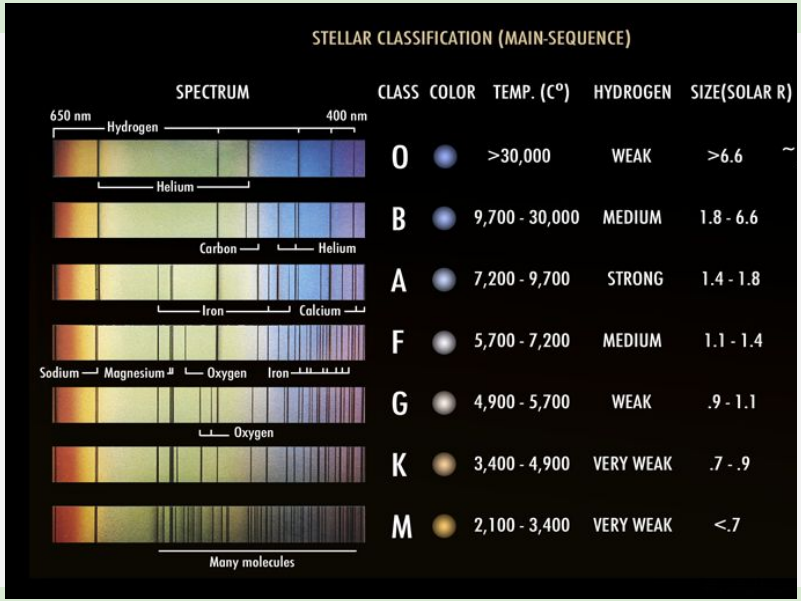
He also serves as a faculty mentor for the **Columbia National Osterbrock Leadership Program** where he trains future scientific leaders in physics.

Observation techniques and instrumentation used by **Marcel Agüeros**

Agüeros' work involves using **spectrography** and **photometry** to catalog groups of stars, from which he can extract information such as age estimates.

$$f_\nu(d) = \frac{L_\nu}{4\pi d^2}$$

Flux to luminosity and distance relation

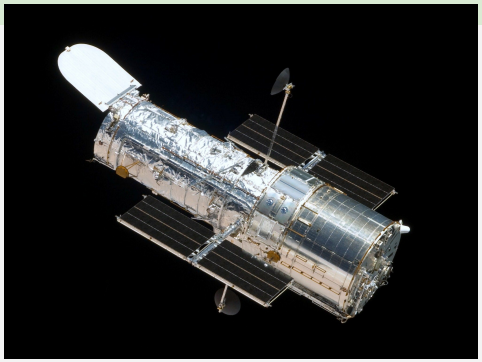


Stars are categorized according to their **spectral type**. By simply looking at their color and absorption spectrum, astronomers can rapidly determine a star's general chemical composition.

Photometry involves measuring the **flux** (intensity of light) coming from a star. From this, the luminosity or distance from the star can be determined.

Observation techniques and instrumentation used by **Marcel Agüeros**

He makes use of a variety of cutting-edge telescopes to accomplish his research, such as the **Hubble Space Telescope, Pan-STARRS,** and **Keck Observatory** in Hawaii.



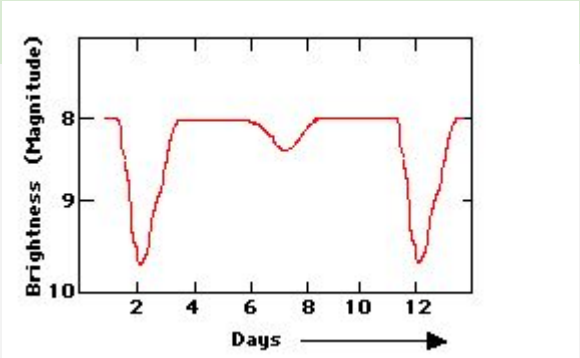
Hubble Space Telescope

Hubble and **Keck** are equipped with **spectrographs**, specialized instruments used to decompose the absorption spectrum of far away stars. **Pan-STARRS** has the **world's largest astronomical camera**, able to monitor changes in brightness from objects such as **supernovae**.

Keck telescopes, Hawaii

Marcel Agüeros has discovered new star clusters and stellar populations

Agüeros is involved in identifying and studying new **star clusters** within the Milky Way. This research has provided insights into the ages, metallicities, and evolution of stars in different regions of our galaxy.



Light curve from an eclipsing binary

One of Agüeros's latest papers describes the discovery of previously unknown star clusters using data from **Pan-STARRS** and the **Sloan Digital Sky Survey (SDSS)**. He accomplished this by studying the light curves from these datasets.

Marcel Agüeros studies magnetic activity and stellar flares

Agüeros studies **magnetic activity** in **low-mass stars**, particularly the impact of **stellar flares** on the stars themselves and their surrounding environments. Such stars (like **red dwarfs**) are known to exhibit strong magnetic activity, but the exact nature of these flares and their variability was not fully understood until recent studies.

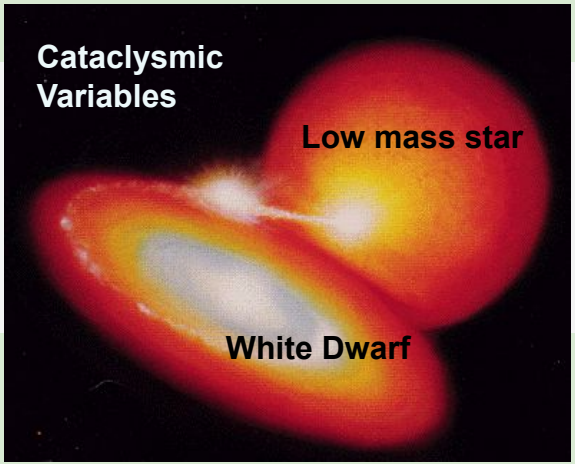
A stellar flare

Agüeros and colleagues found that **low-mass stars** can experience exceptionally powerful flares, releasing large amounts of energy in short periods and altering the atmospheres and habitability of exoplanets orbiting in close proximity.

Marcel Agüeros studies interacting binary star systems

Agüeros also works on **binary** and **multiple star systems**, investigating how such stellar bodies interact, **exchange mass**, and affect each other's evolution. These systems are particularly interesting for studying **stellar life cycles**, especially in close binary systems, where stellar material can be **transferred between stars**.

This work has highlighted how these interactions can lead to the formation of **cataclysmic variables,** a binary system composed of a white dwarf and a low mass star.



Marcel Agüeros is an advocate for diversity in higher level physic-related studies

Prof. Agüeros has worked on increasing the numbers of women and underrepresented minorities in the sciences since starting graduate school. At the University of Washington, he helped create the Pre-Major in astronomy Program, where first-year underrepresented students interested in astronomy are exposed to research, and which now has over 100 alumni.

His is a recipient of an NSF CAREER award and of the Presidential Early Career Award for Scientists and Engineers (PECASE), and he has won Columbia University Lenfest Distinguished Faculty Award, its Presidential Teaching Award for Faculty, and its Faculty Service Award.

Dr. Agüeros is very proud of his Puerto Rican heritage. In a journal article written by *Ciencia Puerto Rico,* he expresses that a pivotal moment in his scientific journey was when he participated in a summer internship at the Arecibo Observatory.

“At that point my research experiences hadn't been particularly rewarding. But I had a really great time working (in Arecibo) with Dr. Kiriaki Xiluri, a terrific mentor. I think that experience made me imagine I could be an astronomer, even if it took another 10 years before I got comfortable saying: I am an astronomer!"

Resources:

- News article: https://www.cienciapr.org/en/monthly-story/marcel-agueros-junction-world-class-astronomy-and-passion-diversity
- Webpage: https://lsstdiscoveryalliance.org/programs/catalyst-fellowship/mentors/marcel-agueros/
- Research papers : https://inspirehep.net/authors/1037060
- Bridge Program to PHD: https://bridgetophd.facultydiversity.columbia.edu/directory/marcel-agueros

Images:

- stars , slide 1: https://exoplanetes.umontreal.ca/en/research/astrophysique-stellaire/
- Marcel Agüeros, slide 1: https://www.wsj.com/articles/an-astronomers-most-beloved-telescope-1483553781
- Stellar Classification. Slide 2: https://en.wikipedia.org/wiki/Stellar_classification
- Hubble space telescope, slide 3: https://en.wikipedia.org/wiki/Hubble_Space_Telescope
- Keck telescopes, slide 3: https://en.wikipedia.org/wiki/W._M._Keck_Observatory
- Star cluster, slide 4: https://en.wikipedia.org/wiki/Star_cluster
- Light curves, slide 4: https://imagine.gsfc.nasa.gov/science/toolbox/timing1.html
- Stellar Flare, slide 5: https://skyandtelescope.org/astronomy-news/which-keplers-stars-flare/
- Cataclysmic variable, slide 6: https://heasarc.gsfc.nasa.gov/docs/objects/cvs/cvstext.html
- Marcel Agüeros, slide 8: https://www.cienciapr.org/en/monthly-story/marcel-agueros-junction-world-class-astronomy-and-passion-diversity
- Arecibo Observatory, Puerto Rico, slide 8: https://www.forbes.com/sites/davidthier/2020/12/02/remembering-the-collapsed-arecibo-observatorys-famous-video-game-level/