GALACTIC ARCHAEOLOGY | KIRSTEN BANKS

PODCAST TRANSCRIPT

UNSW Centre for Ideas: Welcome to 10 Minute Genius, an eight-part series created by the UNSW Centre for Ideas, to provide pause and create a space to engage with new ideas from UNSW Sydney's thinkers, dreamers and envelope pushers, as they help to make sense of the relentless information vortex in which we live. In under 10 minutes, or roughly the same amount of time it takes for light to travel 180 million kilometres, Astrophysicist Kirsten Banks explains how light emitted by the stars can unlock the secrets to our galactic neighbourhood.

Kirsten Banks: Imagine it's night-time, you're in an unfamiliar place, and it's so dark you can't see anything except for some distant lights. Now imagine you had to map the area to find out how far away those lights were. If you've got nothing for reference, that's a tough ask, you think, is that light fainter than the one next to it because they're further away, or are they the same distance, but coming from different intensity light globes? It would be a whole lot easier to measure distance if you knew that light A, B, and C are streetlights. Especially if you know that all street lamps use the same type of light globe and have an equation where the intensity of the streetlights, you see, helps calculate how far away they are. This is kind of what it's like for an astrophysicist like me, exploring our galactic neighbourhood from Earth. While an archaeologist digs down to explore mysteries of our past, a cosmic archaeologist, like myself, does mind digging upwards through space to illuminate the history of our universe.

When we look at stars, we're looking back in time. The light we're seeing has spent a long time traveling unfathomable distances through the cosmos to our eyes. Even the light from our nearest star, the Sun, takes over eight minutes to reach us from over 150 million kilometres away. The relationship between time, light and space is second nature to an astrophysicist, which is why we measure distance in space as light years or the distance light travels in one Earth year. But not all stars are the same. The light in our intergalactic streets are not only different distances away, but come in different sizes, chemical compositions and stages of evolution.

That's why we rely on measuring distances in space using stars that we know have a consistent spectral fingerprint. We call these standard candles, because they allow us to measure distances in the same way as if they're cosmic streetlights with standard light globes in them. We know all about the light, they give off, its makeup and intensity, and therefore we can more confidently measure the distance. My research is all about being able to tell our standard stellar candles from the rest, so we can use them to learn about our neighbouring galaxies.

When everyone else is winding down for the night, my day is just beginning. My work involves pulling a lot of all nighters when it comes to time to collect data. It looks a bit sci-fi. I work in a room with a lot of computer screens, and when I log on here in Sydney, I'm connecting remotely with a telescope far from the city lights in Coonabarabran. I have a list of stars and targeting for my research. I'm looking at two different types of stars, red clump stars, and red giant branch stars. Red clump stars are standard candles, perfect for measuring distance, but they can be hard to tell apart from red giantbranch stars. Both of these types of stars are at a similar stage of evolution, and appear similar on the surface. But it's the inside that counts. The structure of these stars' cores is where you can sort your red clumps from your red giant branches. It's like having to peel your fruit to tell apples from oranges.

Traditionally, we've relied on a field called asteroseismology to help tell these stars apart, so that we can map the cosmos. Asteroseismology uses a light emitted from stars to allow us to tell the different types apart. Just as you can tell that glass bottles are different by hearing the pitch you get from blowing in them, you can also tell the difference between different types of stars by studying the oscillation in the light waves they produce over a long period of time. The only problem, this can take days, months, or even years at a time to do for each star. I'm a PhD student so I don't have that kind of time. Instead, I'm trying to forge a new faster path to identifying our cosmic streetlamps. I spend all night, every night, collecting the light from red clump stars and red giant branch stars – apples and oranges – so I can study their spectra, which tells us the makeup of the light these stars omit so we can tell them apart. If we can use this spectral signature as a fingerprint to tell us what type of style we're looking at, we could speed up our process so that it takes minutes, not years. That would also be a giant leap forward in finding our way around our galactic neighbourhood without even leaving home. And if my research makes that leap forward possible for the field, that would be a dream come true. And possibly a few less all nighters.

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