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REACHING FOR THE STARS

Lamb, left, and Venn working with adaptive optics components at NRC Herzberg in Saanich. UVIC PHOTO SERVICES

UVic know-how is helping world astronomers peer more closely into the cosmos

by Kim Westad

University of Victoria astronomer Kim Venn and PhD student Masen Lamb want to take the twinkle out of the stars in their search for more insight into the origin of the universe.

That twinkling—which draws stargazers and inspires writers, musicians and romance—is caused by turbulence in the Earth's atmosphere. But it wreaks havoc for astronomers, who can't get the detailed images they need unless they build telescopes in space or develop technology that compensates for the turbulence.

"It's like trying to study birds from the bottom of a swimming pool," says Venn.

A UVic-led project known as Raven has developed a new way to improve our views of the night sky using cutting-edge adaptive optics—a system of thin mirrors and tiny lenses that change shape 500 times in a second to compensate for image distortions caused by the atmosphere.

The beauty of Raven is that it applies adaptive optics corrections to more than one star at a time. "This is a breakthrough because in the past two or more stars could not be corrected simultaneously," explains Lamb. "It vastly widens the scope of sky we can study."

The Raven system has been successfully demonstrated at the eight-metre Subaru telescope at the summit of Maunakea on the island of Hawaii. Lamb, as part of his PhD program at UVic, is now analyzing data gathered from that demonstration.

The Raven technology is expected to be an integral part of the world's next generation of large telescopes. This includes the Thirty Meter Telescope, a new international facility being built on Maunakea for 2024. Canada is a founding member of the project.

This kind of project, as well as the partnerships with national and international scientists and organizations, is an important part of UVic's new Astronomy Research Centre (ARC), says Venn, the centre's director and the Canada Research Chair in Observational Astrophysics.

The centre gives UVic students the opportunity to work on projects in conjunction with NRC Herzberg Institute of Astronomy and Astrophysics in Saanich, which is Canada's leading centre for astrophysical research and associated technologies.

"Just by proximity, we're in a gifted position," says Venn. "It's a natural conduit for graduate students."

NRC Herzberg has more than 20 astronomers and works with engineering teams around the world. Now, more UVic students will have that chance as well. That includes continuing work on astronomical engineering projects such as adaptive optics.

By removing the twinkling in the telescope image, adaptive optics permits astronomers to peer into very star-dense environments, such as the centre of our Milky Way galaxy. This is where astronomers hope to find the first stars created just after the Big Bang about 13.6 billion years ago.

"We have yet to find these oldest stars, which should be missing the metals formed in other stars much later," says Venn. Adaptive optics will help to pierce through the interstellar dust that so far has blocked our view of the galactic centre. Still, Venn and Lamb know it will be like finding a needle in a haystack.

The challenge of finding a star that would have been among the first objects to form in the universe is daunting but thrilling, Venn says.

"Our galaxy had eight billion years to evolve before forming the sun," says Venn. "Knowing more about the first stars in the early universe ultimately leads to a better understanding of the solar system and the origins of life on Earth."

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UVic astronomers and engineers are world-renowned for their work on galaxy evolution, star formation, exoplanets (planets around other stars) and cosmology, and have built several important astronomical instruments for space-based satellites and ground-based observatories around the world.

The close ties between UVic and NRC Herzberg makes the Victoria region home to one of the largest concentrations of astronomy talent in Canada—now grouped under the umbrella of UVic's Astronomy Research Centre (ARC).

Raven is a multi-object adaptive optics instrumentation project led by UVic researchers, working closely with NRC Herzberg and astronomers at the National Astronomical Observatory of Japan and Tohuku University in Japan.

Adaptive optics is essential for the next generation of ground-based telescopes to peer into space with the sharpest vision possible.

ARC researchers are leaders in developing the next generation of astronomical facilities, including the Thirty Meter Telescope in Hawaii (which will be the largest optical telescope on the planet), the Atacama Large Millimeter/submillimeter Array in Chile, and the powerful James Webb Space Telescope, scheduled for launch in 2018.

Meet Kim Venn at *bit.ly/uvic-venn*