NIGEL BISHOP

AWARDS, HONOURS AND ACHIEVEMENTS

- South African Mathematical Society World Mathematical Year 2000 Gold Medal (2001)
- Chancellor's Prize for the best researcher in the Faculty of Science, University of South Africa (Unisa) (1999)
- Senior Scholarship, University of Cambridge (1972)

DEFINING MOMENT

In the 1980s he realised that research in gravitational waves would become very important in the future.

WHAT PEOPLE MIGHT NOT KNOW

His very first scientific article, during his PhD, was published in *Nature*.

HUNTING FOR GRAVITY WAVES

Everything in the universe exists within space-time fabric that can be stretched, pulled, bent and disturbed. Learning this sparked a young man's interest in how the universe works. Albert Einstein changed the field of physics with his theories of how gravity is an effect of space bending and rippling, and this thrilled Nigel Bishop from the very start.

As an undergraduate at Cambridge University, he was fortunate enough to be tutored by the most famous astrophysicist in the world, Professor Stephen Hawking. There he developed his passion for studying black holes (Hawking's speciality): exotic objects that bend space-time so much that they create gravity waves as they move through space and ripples that can be heard across the galaxy when they dance around each other and collide.

"I remember as a child being fascinated by astronomy and generally reading a lot of encyclopaedias. I was fortunate to attend Cambridge University, which stimulated my interest in that border area between mathematics and physics," he says. He would continue in his teaching career lecturing both mathematics and physics subjects at institutions in South Africa and the United Kingdom.

He completed a PhD in gravitation theory and cosmology at the Department of Mathematics at the University of Southampton in 1976 with a thesis titled *A trip through gravitation theory*, and was elected a Fellow of the Royal Astronomical Society.

Inspired by his love of mathematics and the teachings of Professor Hawking, Bishop's interest in the nature of these heavenly bodies that twist and knot the fabric of space and time burgeoned. He would dedicate his career to studying what happens at the boundaries of black holes, how they bend space-time, and how their movements ripple across the cosmos.

"From the mid-1980s, I came to realise that the study of gravitational waves research was going to be very important in the coming years," he says. His prediction was spot-on as the study and detection of gravitational waves has become increasingly important both in the public discourse and the scientific field as detectors have been built and research has been conducted to make sense of the new data streaming in from the cosmos.

The detection of gravitational waves has been in the news regularly for the past five years, but it took many years of work by researchers like Bishop, starting in the 1960s, to make such every-day detections possible. "At the time, we had no idea just how infrequent the events we were looking for could be," he says. "If an event causing gravity waves in space is close by, it would have been easy to detect it with the technology that existed in the 1960s. The probability of that was just very low back then."

"What has changed the field is doing calculations that are relevant to the results," he says. "The first successful gravitational wave experiment, the original Laser Interferometer Gravitational-Wave Observatory (LIGO) machine, came online in 2001." LIGO has gone on to detect gravitational waves from events such as the collisions of neutron stars.

"After I got my PhD in the late 1970s, there were no real opportunities to do what I wanted in my preferred field." Bishop then moved to South Africa to take up a position as Lecturer at the University of the Witwatersrand (Wits). While at Wits he was promoted to senior lecturer and later associate professor where he taught gravitational theory and cosmology among other subjects. His first appointment as full Professor of Mathematics was at Unisa, where he lectured

in second-level computer algebra and general relativity at the honours level, among others.

BEHAVIOUR OF BLACK HOLES

Throughout his career, he has focused on calculating the properties of the boundaries of black holes. This would allow him to measure or predict gravitational wave emissions from events involving black holes. His work that had the most impact saw him developing computer models of the behaviour of black holes, using methods that optimised computational efficiency.

Thanks to recent advances in computing technology, supercomputers can now render fully three-dimensional models of the Einstein equations. Along with recent instruments such as LIGO being installed around the globe, these advances have allowed Bishop to make sense of the data coming from deep space and to understand what it says about gravitational waves.

He was recognised for his work as Director of the Research Centre for Computational Relativity, Astrophysics and Cosmology (CRAC) while he was at Unisa. He was also President of the South African Mathematical Society from 2003 to 2007, as well as a founding Director of the South African Mathematics Foundation that he chaired in 2006, from 2009 to 2010, and from 2013 to 2014. He further held numerous appointments as Visiting Professor at the Universities of Cambridge and Southampton, the Max-Planck Institute for Gravitational Physics and the University of Pittsburgh.

The universe continues to hold many mysteries that Bishop still wonders and is passionate about. He is currently the Emeritus Professor at the Department of Mathematics and Applied Mathematics at Rhodes University.

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