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GIRLS IN PHYSICS
@GIPPSLAND 2026

Improving X-ray Imaging with a Piece of Sandpaper and some New Maths!

Dr Samantha Alloo
Postdoctoral Researcher
School of Physics and Astronomy, Monash University

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Wednesday September 16th, 2026
Morning Tea | 9.30am to 12.00noon
Morwell Campus, Federation University

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Speaker Bio: Dr Samantha Jane Alloo is an imaging physicist in the X-ray Imaging Group at Monash University. She is interested in developing new ways to see inside materials and biological samples using X-rays, and in finding connections between different areas of physics and mathematics. Outside of research, Samantha has an equal passion for fitness. She works part-time as a fitness coach and regularly competes in challenging events, including HYROX competitions, where she has achieved several podium finishes.

Dr Alloo earned her PhD in Medical Physics from the University of Canterbury, New Zealand, in 2024. Her research combines physics, mathematics, synchrotron experiments, software development and data analysis.

Abstract: By placing a simple piece of sandpaper into a conventional X-ray beam, we can dramatically increase the amount of information we can get from an X-ray image. The sandpaper creates a pattern of tiny bright and dark spots, called speckles, that land on the object we are taking an image of. As these X-ray speckles pass through an object, the speckle pattern changes depending on which structures it goes through. By measuring the different ways the speckles change, for example, whether they become dimmer, move, or blurred, we can extract three different images of the object.

This means that, instead of getting just one image from a conventional X-ray, we can obtain two additional images, which are called phase-contrast and dark-field images. These extra images reveal things that are difficult or even impossible to see with conventional X-ray imaging.

Phase-contrast images are particularly useful for seeing thin, low-density materials that are almost transparent to X-rays. For example, it can be used to distinguish different types of soft tissue, like fat versus malignant (cancerous).

Dark-field images reveal tiny structures that are too small to be individually resolved, such as the tiny air sacs (alveoli) in the lungs, which are invisible in a conventional chest X-ray.

To create these two extra images, we need to work out exactly what happened to the X-ray speckles once passing through the object. This is where my research comes in! I use physics and mathematics to track these speckle changes, and hence enrich the information capturable in an X-ray image.

In this presentation, I will introduce first myself, and then my research; X-ray imaging with sandpaper, explaining how it can be used to capture phase-contrast and dark-field images, and how maths can be used to turn speckle measurements into useful X-ray images.

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