School of Physics and Astronomy

IMAGING & OPTICAL PHYSICS SEMINAR

Date: Tuesday 13 August from 2pm
Venue: L1, Seminar Room 107, 10 College Walk, Clayton

2.00 pm - 2:30 pm: Dr. Scott Findlay

Structure retrieval from phase-contrast scanning transmission electron microscopy using a new generation of detectors
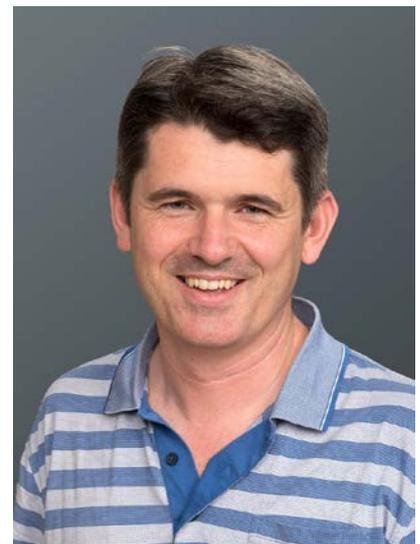
High-energy electrons are effective probes of electromagnetic fields within materials – both long range (e.g. within p-n junctions) and short range (e.g. within atoms) – due to the phase profile that scattering through the specimen's electromagnetic potential imparts on the electron wave-field. In scanning transmission electron microscopy, recent developments in segmented and pixelated detector design have led to a renaissance of phase-contrast imaging methods that enable structure retrieval, the reconstruction of specimen electromagnetic potential. These include differential phase contrast imaging and various forms of ptychography. This talk will overview structure retrieval techniques in phase-contrast scanning transmission electron microscopy, with an emphasis on the assumptions made in different approaches and thus their domains of validity.

2:30 pm – 3.00 pm: Dr. Tim Petersen

Simple Wave-Optical Superpositions as Prime Number Sieves

We encode the sequence of prime numbers into simple superpositions of identical waves, mimicking the archetypal prime number sieve of Eratosthenes. The primes are identified as zeros accompanied by phase singularities in a physically generated wave field for integer valued momenta. Similarly, primes are encoded in the diffraction pattern from a simple single aperture and in the harmonics of a single vibrating resonator. Further, diffraction physics connections to number theory reveal how to encode all Gaussian primes, twin primes, and how to construct wave fields with amplitudes equal to the divisor function at integer spatial frequencies. Remarkably, all of these basic diffraction phenomena reveal that the naturally irregular sequence of primes can arise from trivially ordered wave superpositions.

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