

**NITheCS Colloquium**  
**Monday, 1 August 2022, 16h00 – 17h00 SAST**  
Dr Martin Weigt (Nelson Mandela University)

## **'Generalised B\*-algebras with applications to quantum mechanics'**

### **ABSTRACT**



Observables in quantum mechanics, such as position, momentum, and the Hamiltonian, are self-adjoint unbounded operators on a Hilbert space. More generally, one can consider such observables to be self-adjoint elements of a  $*$ -algebra. A special class of locally convex  $*$ -algebras, which can be faithfully represented as  $*$ -algebras consisting of unbounded linear operators on a Hilbert space, are generalised  $B^*$ -algebras ( $GB^*$ -algebras for short). First studied by G.R. Allan and P.G. Dixon during the late sixties to early seventies, they are generalisations of  $C^*$ -algebras.

I will introduce generalised  $B^*$ -algebras, along with some basic results. These include generalisations of the Gelfand-Neumark representation theorems for  $C^*$ -algebras to generalised  $B^*$ -algebras. I will also discuss how generalised  $B^*$ -algebras can be applied to quantum mechanics, and is a bird's-eye view of recent work.

In particular, I make the case for linearly nuclear  $GB^*$ -algebras as appropriate locally convex  $*$ -algebras of which its self-adjoint elements are regarded as observables appearing in quantum mechanics (by linearly nuclear, I mean nuclear as a locally convex space). I start by putting linearly nuclear  $GB^*$ -algebras in the context of the rigged Hilbert space framework, followed by how one can study quantum entanglement of states within the setting of linearly nuclear  $GB^*$ -algebras. Investigations of quantum entanglement lead to results on pure states and integral representations of states of  $GB^*$ -algebras, which we will also discuss.

This talk will address a non-specialist audience who might not know anything about unbounded operator algebras and generalised  $B^*$ -algebras in particular.

### **BIOGRAPHY**

Dr Weigt graduated with a BSc degree (1999), BSc (Hons) degree in Mathematics (2000) and an MSc in Mathematics (2003) at the University of Stellenbosch. In 2008, he obtained a PhD in Mathematics at the University of Cape Town.

Dr Weigt's field of expertise is in functional analysis: Operator algebras, Banach algebras,

topological algebras and unbounded operator algebras.

He currently holds a C2 rating with the National Research Foundation (NRF) and is a senior lecturer in Mathematics at the Nelson Mandela University in Gqeberha (Port Elizabeth).

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