Title: Logic of Contextual Semantics

Abstract:

Contextuality is a key feature of quantum physics that provides an important resource for quantum information and computation, but it is a phenomenon found in many other fields as well.  Indeed, in the sheaf-theoretic approach to contextuality by Abramsky and Brandenburger (2011), models are provided for not just quantum but all no-signalling theories.  In this talk I will show how no-signalling models can be used as semantic structures.

One of the core insights of the sheaf-theoretic approach is that contextuality consists in the combination of local consistency and global inconsistency.  This understanding leads to the idea that contextuality involves two sorts of logic: the logic of global (in)consistency but also the logic of local (in)consistency.  The latter has not been explicitly studied before, but it is in fact the logic of no-signalling models as semantic structures.  I will explore how the global and local logics are related, and study instances of contextuality as manifestations of the variance between the two logics.  One instance is found in the so-called all-versus-nothing argument, a typical contextuality argument used in the quantum foundation literature.