ST. FRANCIS XAVIER UNIVERSITY

Physics Colloquium

Thursday, 25 March 2010, 12:00pm, room t.b.a.

Dr. Iain A. Brown

Institute for Theoretical Astrophysics, University of Oslo

A Weak Dark Sector from Averaging

Observations indicate and seem to require that up to 95% of the mass energy of the universe is composed of two unknown "dark" components – the dark matter and the dark energy. No overwhelmingly convincing candidates for either exist, and particularly not for the dark energy. However, these observations are strongly reliant on the cosmological model employed. Cosmology is based on the Friedmann-Lemaitre-Robertson-Walker metric, which presupposes that 3D spatial surfaces are totally smooth, something which has obviously never been true and is increasingly less so.

I discuss a generalised form of the so-called "Buchert averaging" which constructs an effective FLRW model from inhomogeneous surfaces and to find a first estimate of the corrections to the assumed scale factor that may be induced, apply this to standard cosmological perturbation theory. While these corrections are necessarily extremely small due to the use of perturbation theory, I find that the corrections induced by scalar perturbations act as a dark matter from approximately matter/radiation equality, while those from tensor perturbations act in the late universe as an emergent dark energy with equation of state w=-8/9. It is worth emphasising that I do not claim to solve the dark matter and dark energy problems; rather, I demonstrate that effective fluids with the required properties can emerge from averaging and, potentially, this might contribute to the observations.