Western Science

DEPARTMENT OF PHYSICS AND ASTRONOMY

# Physics Undergraduate Conference (PhUnC)

# KEYNOTE TALK

**Thursday, 15th March 2018 @ 2:30 p.m.**

**PAB Room 106**

# Dr. Neil Turok

Director, Perimeter Institute for Theoretical Physics

## "Quantum Universe"

Observations reveal the cosmos to be astonishingly simple, and yet deeply puzzling, on the largest accessible scales. Why is it so nearly symmetrical? Why is there a cosmological constant (or dark energy) and what fixes its value? How did everything we see emerge from a singular "point" in the past? Many lines of evidence now point to a quantum beginning, in which spacetime itself was governed by quantum laws. One approach is the famous "no boundary" proposal of Hartle and Hawking—another, "tunneling" proposal of Vilenkin. Both invoke the cosmic inflation scenario, requiring ad hoc ingredients and assumptions like an initially dominant "inflaton" field. Recently, using powerful new mathematical techniques, we have proven both proposals to be inconsistent with the almost smooth, uniform universe we observe on large scales. More excitingly, we now have a glimpse of a far more minimal, quantum "causa sui" cosmology in which no extra ingredients, beyond the known laws of physics, are needed to explain the universe's broad features.