2016 CAP LECTURE TOUR

The Canadian Association of Physicists (CAP)
and the
Department of Physics and Astronomy
Trent University
present

Date: Wednesday, March 9, 2016

Time: 11:00 a.m.

Room: Science Complex 115

"Cosmology, Cell Phones & Video Games: The Canadian Hydrogen Intensity Mapping Experiment"

Professor Keith Vanderlinde
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University of Toronto

Abstract:

The measurement of cosmic acceleration – the increasingly rapid expansion of the Universe over time – was awarded the Nobel Prize in Physics in 2011, and signals either that a gravitationally repulsive dark energy dominates the energy density of the Universe today, or that Einstein's General Relativity does not correctly describe gravity on cosmological scales. The impact of this discovery on fundamental physics and astrophysics has been revolutionary, and decoding the physics of cosmic acceleration requires new, higher-quality measurements of the expansion rate of the Universe as a function of time. Hydrogen Intensity (HI) mapping uses redshifted 21cm emission from neutral hydrogen as a 3D tracer of Large Scale Structure (LSS) in the Universe. Imprinted in the LSS is a remnant of the acoustic waves which propagated through the primordial plasma. This feature, the Baryon Acoustic Oscillation (BAO), has a physical size of ~150 co-moving Mpc, which appears in the spatial correlation of LSS. By charting the evolution of this scale over cosmic time, we trace the expansion history of the Universe, constraining the Dark Energy equation of state just as it began to influence the expansion of the Universe. In this talk I will introduce CHIME, an ambitious new radio telescope being built in British Columbia, Canada. CHIME is a transit interferometer designed to measure the BAO via 21cm line emission, covering a bandwidth of 400-800MHz, corresponding to a redshift range of $0.8 < z < 2.5$. It is composed of four 20m x 100m parabolic reflectors which focus radiation in one direction (east-west), while interferometry is used to resolve beams in the other (north-south). Earth rotation sweeps them across the sky, resulting in complete daily coverage of the northern celestial hemisphere.

Bio:

Professor Keith Vanderlinde is a cosmologist based at the University of Toronto, studying the Universe on the largest possible scales: its overall composition, history, behaviour, and eventual fate. He established and leads the Dunlap Institute's Long Wavelength Lab, where technologies are developed and assembled into highly specialized telescopes targeted at these questions. These instruments require equally specialized operating environments: as an example, Dr. Vanderlinde spent 2008 living and working at the geographic South Pole, operating the aptly-named South Pole Telescope. Now, aided by developments in communications and computing technologies, he joins a team from across Canada in building CHIME, a massive new radio telescope in Penticton, B.C., which will soon begin mapping a larger volume of space than ever attempted before. He presents frequent public lectures through the GTA, was a 2014 TEDxToronto speaker, and has delivered dozens of academic talks worldwide. Born and raised in Fredericton, New Brunswick, Dr. Vanderlinde received his BSc from the Massachusetts Institute of Technology (2002), his PhD from the University of Chicago (2008), and undertook postdoctoral studies at McGill University (2009-2012) prior to taking up his current post at the University of Toronto in 2013.