

**SCHOOL OF PHYSICS**

**UNIVERSITY OF NEW SOUTH WALES**



# COLLOQUIUM

*4-5 p.m., Tuesday, 06 October 2009*

School of Physics Common Room  
Room 64, Old Main Building

**Prof. Michael Tobar**

School of Physics, M013, Frequency Standards and Metrology Research Group, Radio Frequency Division, The University of Western Australia

## **"Precision Oscillator, Clocks and Interferometers with Applications to Space, Industry and Fundamental Physics"**

Many modern developments in a technological society are based on high quality clocks, oscillators and phase measurement. This includes; Global Positioning System (GPS) satellite system, radar, fibre optical communications and even mobile phones. The goal of my research group is to develop new precision measurement techniques with two endpoints in mind: to improve systems that are based on high quality clocks, oscillators and interferometers and the use of these as precision tools to test the foundations of physics. We have already used our techniques to make the most sensitive test of one of the founding theories of modern physics: Einstein's Theory of Relativity. In the near future we will use our devices to test new theories of cosmology, and to search for evidence of "new physics" that goes beyond the present conception of physics. We are dedicated to commercialising our inventions and thus hold patents in conjunction with industry. Our research programs include strong international and industrial collaborations.

In the microgravity environment of space an orbiting laboratory in "free fall" allows the operation of precision technology away from the perturbations of gravity. Thus an orbiting laboratory (such as a satellite) can have significant advantage over a terrestrial laboratory. For example, the European Space Agency's Atomic Clock Ensemble in Space (ACES) Mission is due to be launched in 2013. The mission will bring a new generation of atomic clocks to the micro gravity environment of the International Space Station. The ACES payload will distribute a stable and accurate time base that will be used for space-to-ground as well as ground-to-ground clock comparisons. The direct comparison of ultra-precise clocks is crucial for the exploitation of ACES potential in many different areas of research such as, Fundamental physics (General Relativity and String Theory tests), time and frequency metrology, geodesy and gravimetry precise orbit determination, earth monitoring, very long baseline interferometry and global positioning and navigation.

The audience is invited to meet the speaker beforehand at 3.45 p.m. over coffee and biscuits in the Common Room.

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