Physics Colloquium

Space-Time Referencing With Lasers

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Abstract:
Advances in precision laser spectroscopy, laser-cooling and trapping of atoms, and femtosecond optical frequency combs have resulted in revolutionary improvements in the performance of atomic clocks and frequency standards. The question now becomes how can we best take advantage of that high performance for fundamental science or applications. One of the limitations of the high performance clocks is in transferring “Time” from one location to another. We are exploring the prospects for doing time and frequency transfer using laser links, with the eventual goal of operating links between ground and space. With precise laser time-transfer it will be possible to improve upon the current state of the art in time transfer by roughly a factor of 1000, from the current 1 to 30 ns achieved with GPS to the ≤ 1 ps level. This type of system can also provide range information and precise orbit determination. These capabilities would support and enable future scientific missions such as cold atom clocks in space, tests of General Relativity, high accuracy comparison of ground clocks around the world, and searches for physics beyond the Standard Model. These capabilities would also serve the important function of enhancing the performance of existing GNSS navigation as well as precision measurements in earth sciences such as geodesy and sea level determinations.

Friday, January 24th, 2014
4:00-5:00 pm
Goudsmit Conference Room, LP 208