Physics Colloquium

WEDNESDAY

MARCH 2

4:00 P.M.

RM 118 NSH

Refreshments
in Rm 202 NSH
@ 3:30 pm

The Revolution in Geodesy and Applications in Science using GPS

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Geodesy is arguably the oldest science, considering that the ancient Greeks measured the Earth's radius to within a few percent. The recent revolution in geodesy now enables us to measure changes in the Earth's changing shape, gravity field, orientation in space to better than 1 part per billion. Space geodetic measurement systems started with laser ranging to the moon and satellites, followed by very long baseline interferometry, and now GPS. The position and time coordinates of these geodetic systems relative to the rotating Earth are modeled within the relativistic framework of the International Terrestrial Reference System, with its reference frame origin at the Earth system center of mass. Within this frame, geodetic techniques can position a GPS receiver to within millimeters, and can determine the relative time between satellite and ground clocks to within 0.1 ns. GPS carrier phase signals are synchronized to atomic clocks in the GPS satellite, and are transmitted to Earth. These signals propagate through the atmosphere, and are measured by receivers that may be on the Earth surface, on-board instrumented aircraft, or on-board Earth observation satellites. Thus GPS data are sensitive to a broad variety of Earth processes, and are now being applied in many research areas such as tectonics, geodynamics, rheology, surface mass transport, seismology, the atmosphere, oceanography, Earth's gravity, volcanology, hydrology, and the cryosphere. GPS can also play a role in fundamental physics, whether it be to determine the speed of neutrinos, or to search for topological dark matter. This presentation aims to provide physicists with a review of the recent revolution in geodesy, an understanding of the physical principles of geodesy, and an appreciation of scientific applications that are and might be possible using GPS geodesy.

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