TIFR Centre for Interdisciplinary Sciences
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Seminar

Spin Dynamics in General Relativity

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Since all astrophysical objects spin, it is important to study the dynamics of spinning objects in curved space-time. The dynamics of spinning particles can be described with a covariant Hamiltonian formalism. In this formalism, the closed set of equations of motion is obtained from Poisson-Dirac brackets. Since the brackets are model-independent, a large class of Hamiltonians can be used to describe a variety of models. In this talk, I choose a minimal Hamiltonian to describe spin dynamics.

I apply our formalism to study the dynamics of spinning particles in Schwarzschild background, and establish a number of new results. First, I obtain the equations for the circular orbit of the particle in the equatorial plane. By generalizing the method of geodesic deviation in General Relativity to world lines of particles carrying spin, I derive the complete first-order solution for the non-circular bound orbits. This solution leads to the surprising insight that the periastron is not only subject to an angular shift, but show radial variations as well. Then analyzing the stability criterion for circular motion I find the Innermost Stable Circular Orbits as a function of spin. Finally I show that the spin-orbit coupling leads to geodetic precession of the bound orbits.

Thursday, Aug 4th 2016

4:00 PM (Tea/Coffee at 3:45 PM)

Seminar Hall, TCIS