

Area Seminar

Title How Galilean invariant theories like Navier-Stokes are like gauge theories

Date and
Time 29/12/2011 16:00:00

Speaker Prof. Arjun Berera
 Univ. of Edinburgh, Scotland

Area Theoretical Physics

Venue Room No. 469

Abstract I will first show how the Navier-Stokes equation (NSE), can be expressed in the same formal language as quantum field theory via the path integral. The path integral is useful in understanding some aspects of these systems, in particular Ward identities. I show how to calculate such Ward identities for the fluid dynamics equations. This technique has long been used to study the NSE and other Galilean invariant theories like MHD, Burgers equation and KPZ, however there has been longstanding problems in implementing this method. I show that the origin of these problems is Galilean invariance leads to a redundancy in the path integral similar to that arising from gauge invariance in quantum field theories. I show how this redundancy can be corrected via the Fadeev-Popov method and then I identify an underlying BRS symmetry in the Navier-Stokes path integral. A focal point of the problems with the Navier-Stokes path integral has been on the issue of how the vertex correlation function relates to the response function, and its implications for the nonlinear vertex coupling under renormalization. I show that by our gauge fixing approach, this problem no longer exists.