



**S N BOSE NATIONAL CENTRE  
FOR BASIC SCIENCES**

*Block JD, Sector III, Salt Lake, Kolkata 700 106*

## **DEPARTMENTAL SEMINAR**

# **Physics of Complex Systems**

**19<sup>th</sup> August, 2022**

**3.00 PM**

**ONLINE / FERMION**

### **SPEAKER**

**Mr. SUMIT DEY,**  
**Ph.D. research scholar,**  
**Department of Physics,**  
**Indian Institute of Technology Guwahati, India.**

### **TITLE OF THE TALK**

*Thermodynamic and fluid dynamical interpretation of the Einstein-Cartan field equations with respect to a generic null hypersurface*

### **ABSTRACT**

In the present work, we study the dynamics of a general null hypersurface in the Einstein Cartan (EC) theory generated by the null vector  $l^a$ . We see that under a particular relation between the torsion tensor and the null generators called the geodesic constraint, the dynamical evolution of the ingoing expansion scalar corresponding to the auxiliary null field  $k^a$  is related to the projection component  $G^{\hat{a}b} k^a l^b$ , where  $G^{\hat{a}b}$  is the analogue of the Einstein tensor in spacetime with intrinsic torsion. Similarly, the evolution dynamics of the Hajicek one-form is governed by the component  $G^{\hat{a}b} l^a q^b{}_c$ , where  $q_{ab}$  is the induced metric on an orthogonal spacelike cross-section of the null surface. Using the gravitational field equations for the EC theory, we see that above mentioned evolution equations can be provided a thermo dynamical and fluid-dynamical interpretation respectively. The relevant thermodynamic and fluid parameters have been properly identified. The dynamics of the Hajicek one-form has been studied in a local inertial frame and its correspondence with Cosserat fluid has been established.

The poster will be mainly based on Phys. Rev. D 105, 064047 (2022).

However, it will also take some contents from two papers, one published and the other under communication, both by the same two authors. The respective papers are Phys. Rev. D 102, no.12, 124044 (2020) and arXiv:2206.11875 [gr-qc].

### **HOST FACULTY**

**Prof. Rabin Banerjee, Raja Ramanna Fellow**

**DEPT. OF PHYSICS OF COMPLEX SYSTEMS**

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