

TATA INSTITUTE OF FUNDAMENTAL RESEARCH**Homi Bhabha Road, Mumbai-400 005**

March 29, 2019

ASET Colloquium

Speaker : **Prof. T.P. Singh (TIFR, Mumbai)**

Title : **The Atoms of Space-time**

Date & Time : **Friday 05 April 2019 at 16:00 hrs.**

Venue : **Lecture Theater (AG-66)**

Abstract :

Our understanding of the gravitational force has been evolving over centuries, and we still do not have the final picture. Newton showed that the force that causes planets to go around the sun is the same as the gravitational force which makes objects fall to the ground. Later, Einstein taught us that gravitation is not a force, but the curving of space-time geometry. However, this classical view of space-time geometry is in serious conflict with quantum theory. Because, while the principle of linear superposition holds in quantum theory, it does not hold in Einstein's theory. How do we get past this impasse? In our recent work we have argued that at the most fundamental level, i.e. at the Planck scale, one should no longer make a distinction between matter and space-time geometry. Rather, we talk of 'atoms of space-time-matter' which interact via entanglement and which obey the laws of non-commutative geometry. Quantum theory as well as general relativity are emergent as [mutually exclusive] thermodynamic approximations to this underlying theory. This talk provides a non-technical perspective on our ongoing research programme. We also propose an opto-mechanical laboratory experiment to look for the entanglement of STM atoms.

References:

1. Quantum theory and the structure of space-time, T. P. Singh, Zeitschrift for Naturforschung 73 (2018) 773 [arXiv:1707.01012]
2. Proposal for a new quantum theory of gravity, T. P. Singh, arXiv:1903.05402 [gr-qc]



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