

**ICTS**

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TATA INSTITUTE OF FUNDAMENTAL RESEARCH

## ICTS Astrophysics & Relativity Seminar

**Title** : The cosmic treasure hunt: how does the Universe make the elements like gold

**Speaker** : Smaranika Banerjee (University of Oxford )

**Date** : Friday , 09 October 2026

**Time** : 03:00 PM (IST)

**Abstract** : We are made of, and surrounded by, elements such as oxygen, carbon, iron, and even gold, yet the question of where the heaviest elements, such as gold, come from remains one of the great mysteries in astrophysics. A leading theoretical hypothesis is that these heavy elements are produced in binary neutron star mergers. When two neutron stars collide, they eject neutron-rich matter in which heavy elements are formed through rapid neutron-capture nucleosynthesis, or the r-process. The radioactive decay of these newly synthesized elements powers a short-lived ultraviolet, optical, and infrared transient known as a kilonova. At the same time, the merger produces gravitational waves detectable by ground-based observatories, and associated with gamma ray bursts, making these systems detectable multi-messenger sources. In fact, the first joint detection of gravitational waves and a kilonova in 2017 confirmed neutron star mergers as sites of heavy-element production. Recently more kilonova candidates are detected as a follow-up of the gamma ray bursts (e.g., AT2023vfi). This gives us the opportunity to explore fundamental questions, such as, does these mergers explain the heavy elements we observe in solar system or additional cosmic sources are needed? In this talk, I will introduce the broader context of this field, discuss the open questions, and highlight recent progress in understanding kilonovae and neutron star mergers. Finally, I will introduce the recentmost development happening in understanding the alternate sources of heavy elements and the observational prospects with existing and the upcoming facilities.

**Venue** : Feynman Lecture Hall

Zoom Meeting:

<https://icts-res-in.zoom.us/j/95313336665?pwd=smCoykjp91KMtb6j9So0guxqLtq6g8.1>

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