



PhD in Physics and Master Degree in Physics

LECTURES ON Multi-messenger astronomy

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Abstract: The detection of the gravitational wave event in 2017, named GW 170817 resulting from the merger of two neutron stars and the association of a “short” gamma-ray burst GRB 170817A marked the dawn of multi-messenger astronomy with gravitational waves. Several telescopes all over the world participated in the follow-up of the event and the observations resulted in several insights into the phenomena, such as the structure of neutron stars, the population of the binary merging events, and the enrichment of the universe. The course on multi-messenger will be divided into four lectures focusing on the following subtopics.

MS-Teams link: [Lectures on Multi-messenger astronomy](#)

Lecture 1, Thursday, April 4th 11:00-13:00 (AULA G)

Gravitational waves: Discovery of gravitational event GW 170817 in the light of the present generation of gravitational wave detectors: LIGO-VIRGO-KAGRA and the discovery of the gamma-ray burst GRB 170817A as an electromagnetic (EM) counterpart of GW 170817.

Lecture 2, Friday, April 5th 11:00-13:00 (AULA D)

Gamma-ray bursts: Discovery of gamma-ray burst GRB 170817A and its importance to learn fundamental physics. In this lecture, I will cover the observations and theory of gamma-ray bursts: production and observation of EM signals from radio to very high-energy gamma rays.

Lecture 3, Monday, April 8th 09:00-11:00 (AULA G)

Future generation of Gravitational wave detectors, electromagnetic observations, and their synergies.

In this lecture, I will cover the topics related to the next generation of Gravitational wave detectors and their enormous capability of hunting multi-messenger events. In a hands-on session, I will also give a flavor to building a Universe full of binary neutron stars and how to detect them using a hypothetical GW detector with a simulation tool that had been developed in GSSI- GWFISH.

Lecture 4, Monday, April 8th 15:00-17:00 (AULA G)

Implications of the multimessenger observations on fundamental physics.

In this lecture, I will discuss the implication of future detections on fundamental physics covering the following topics:

- observation of prompt emission of gamma-ray burst and limits on Lorentz invariance violation
- detection perspective of kilonova emission from binary neutron star merger and a sneak peek into a neutron star.
- Cosmology