



Toward multi-messenger and precision astrophysics with Gravitational Waves

IPHC-Strasbourg February 5, 2021

10:30

→ 10:40

Introduction

Orateur: Benoit Mours (IPHC Strasbourg)

🕒 10m

10:40

→ 11:00

Improving gravitational-wave detectors calibration for accurate and precise physics

Orateur: Dimitri Estevez (CNRS)

🕒 20m

11:05

→ 11:25

Enabling multi-messenger cosmology with the LIGO-Virgo alert system

Orateur: Sarah ANTIER (APC)

🕒 20m

11:30

→ 11:50

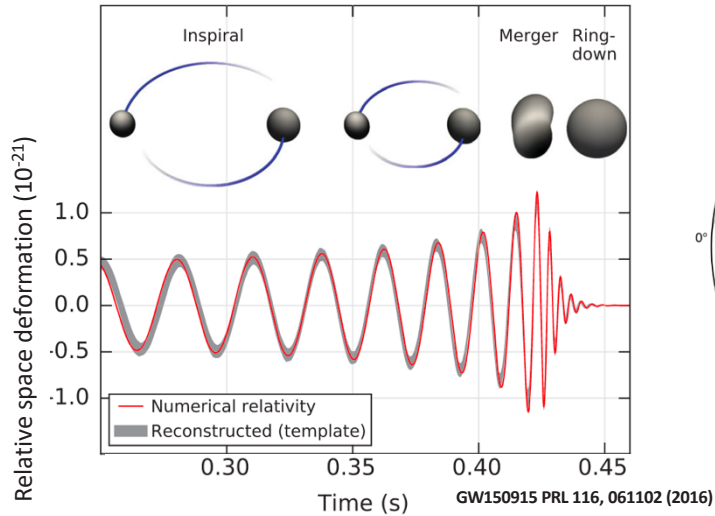
Entering the era of gravitational waves precision astrophysics: signal modelling and tests of new physics

Orateur: Leïla Haegel (Laboratoire APC, Université Paris-Diderot / CNRS)

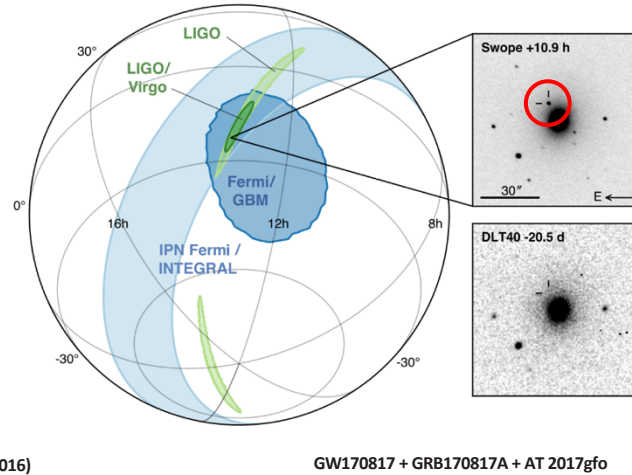
🕒 20m

Gravitational Waves: A Blooming Field

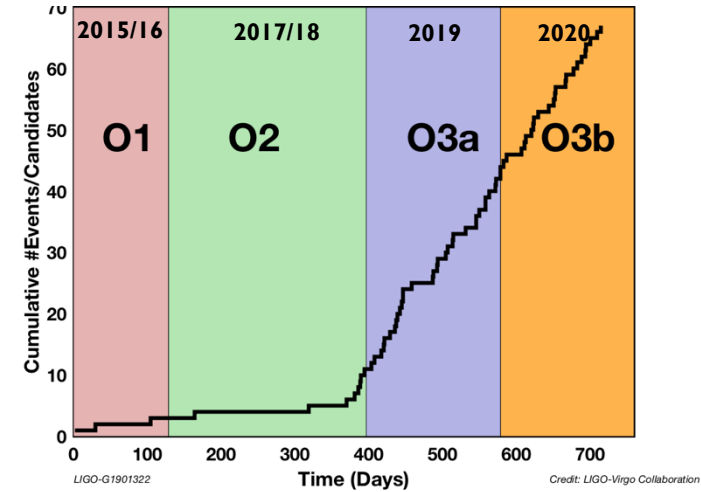
The First Signal



The Dawn of Multi-Messenger Physics



Cumulative Counts of Events



- 2015: First observation of GW: collision of two black holes (BH)
- 2017: First observation of GW from two Neutron Stars + electromagnetic counterparts
- 2018: First LIGO-Virgo catalogue: 11 events (O1+O2)
- 2019-2020: LIGO-Virgo O3 data taking: 56 new alerts released online

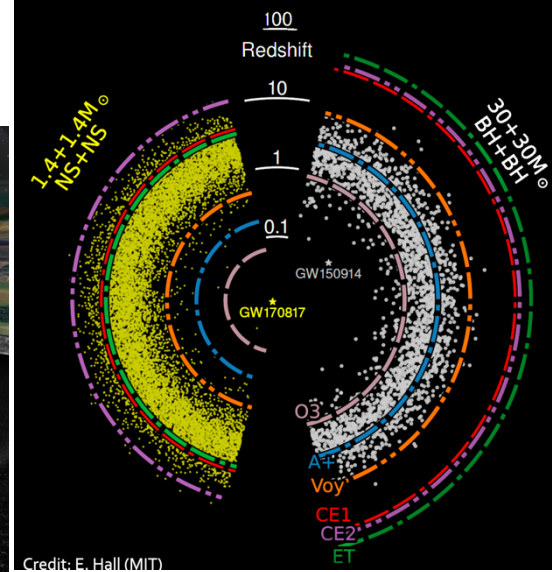
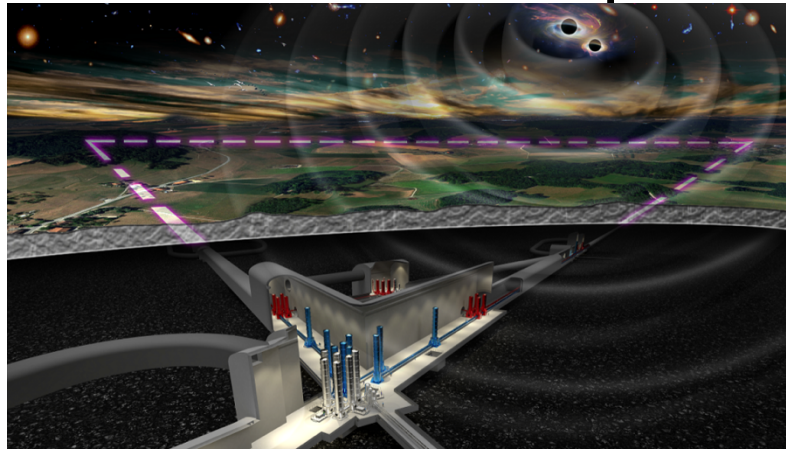
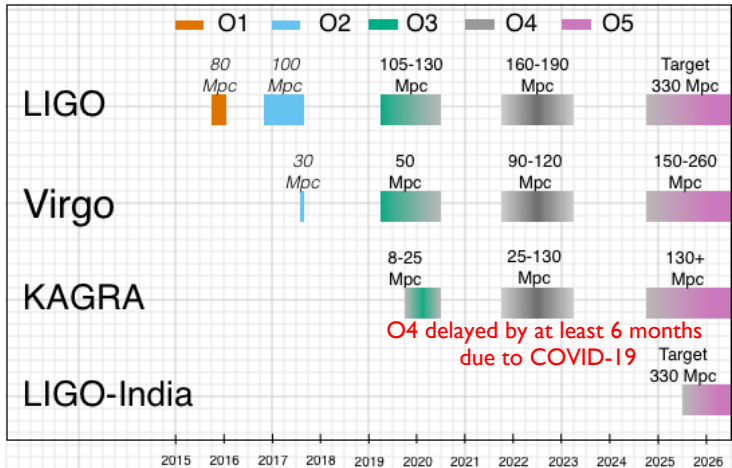
@IPHC: since 2002 GW+HEN;

2019: IPHC joined Virgo;

2021: OGMA

(“Ondes Gravitationnelles & Messagers pour l’Astronomie”)

Coming up: AdV+ and the Einstein Telescope



- 2022+: New data takings of Advanced Virgo+ and aLigo ‘A+’:
 - Volume of space searched increases by up to a factor 50
- 2030+: 3rd Generation proposed: the Einstein Telescope in Europe, Cosmic Explorer in the US
 - Volume of space searched: x1000 \rightarrow enable a large science program, like
 - Sense all stellar-mass BH mergers in the visible Universe: the seed for massive BH at center of galaxies?
 - Precision tests of General Relativity in extreme condition (BH): is GR right or do we need new physics?
 - Insight into how the Universe is expanding and evolving: is dark energy just a cosmological constant?
 - Explore the ultra dense matter: how neutron stars tear each other apart before smashing together?