Multimessenger Astronomy with Larger Field of View Telescopes:

Observational strategies, image analysis, candidate follow-up, study and astrophysical implications.

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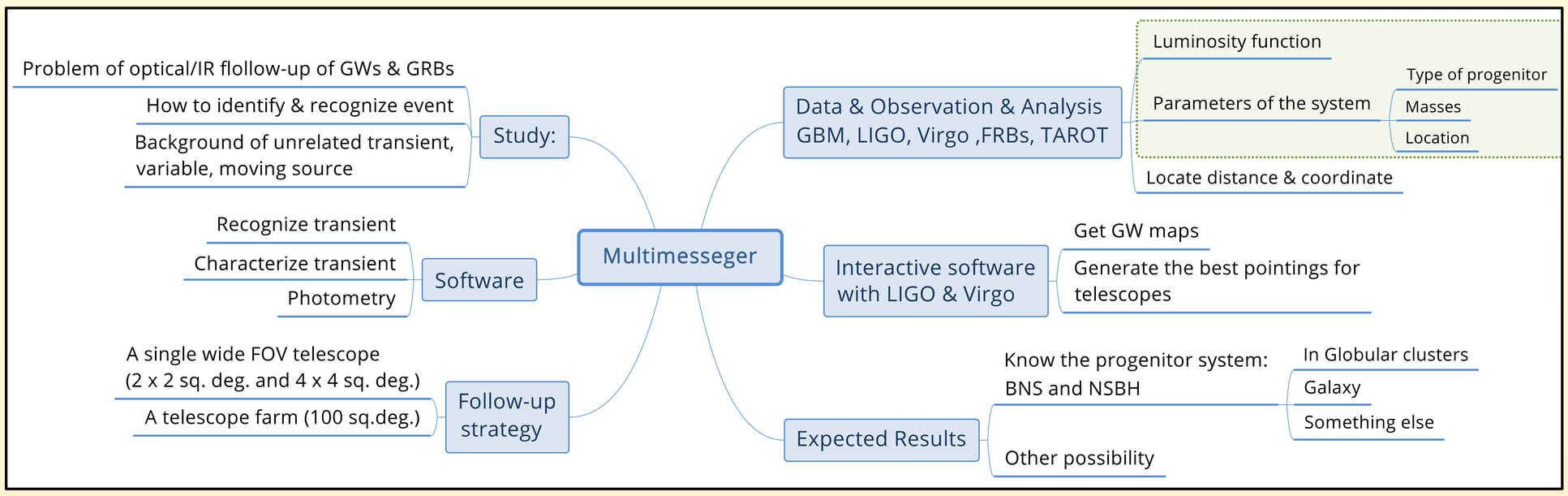
Objectives of thesis:

I. Design algorithm to
*** Identify, recognize transient source.**
*** Implement to TAROT network.**
II. Study the connection between gravitational wave events and Gamma Ray Bursts.

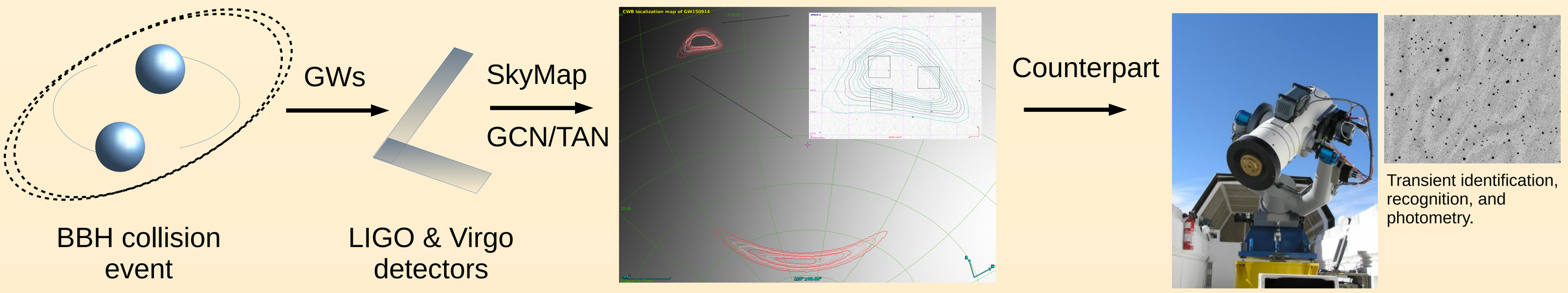
Introduction

Two days after the first observing run 'O1' the Advanced LIGO and VIRGO detectors made their first observation of a binary black hole(BBH) GW150914 on 14 September 2015[1] and two years after the gravitational wave detection of a binary neuron star(BNS) merger GW170817 was confirmed[2] while the second observing run 'O2' of the Advanced LIGO and Advanced VIRGO detectors were being operated. In a next moment, GW1708-17 event was prompted by Gamma - Ray Coordinates(GCN) two seconds after and the electromagnetic counterpart was followed up by multiple observational teams with multi-detectors and instruments for several days[3].



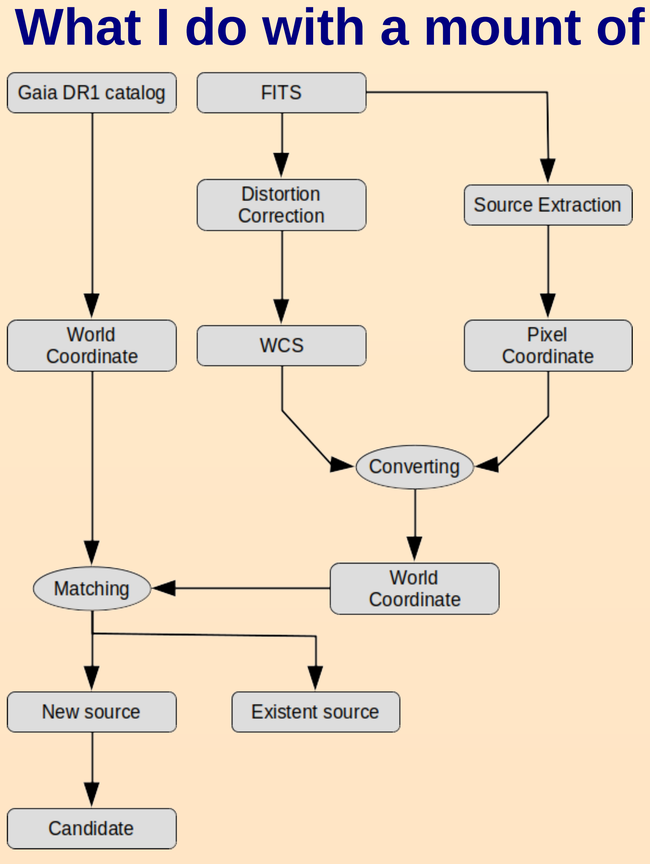
Gravitational wave (GW) events were detected several times in the past three years but a transient source was not detected from a merger of BBH and non of evident of a short gamma-ray burst was reported.

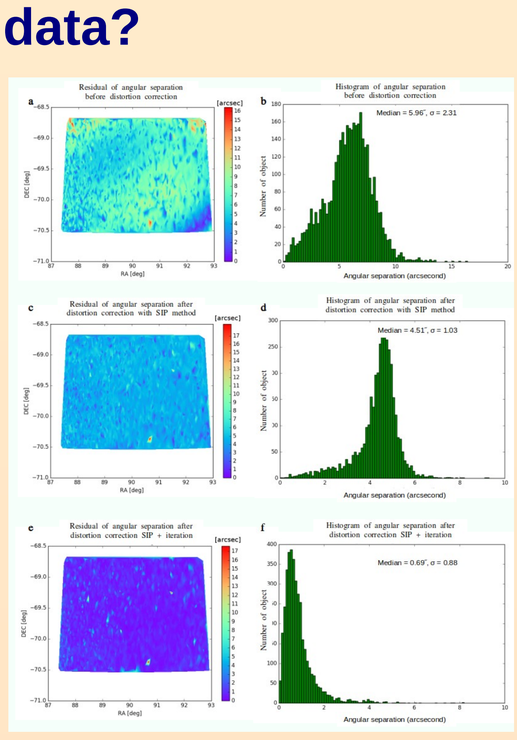
How can I get gravitational wave notices?



When GW event is detected, a series of alerts in feature of sky map is produced and distributed via the Gamma-ray Coordinates Network/Transient Astronomy Network (GCN/TAN). However, GW sources can not be localized to a unique sky location and do not contain a RA and Dec or error radius. Sky map is hundred square deg needed a large field of view(FOV) telescope to counterpart. TAROT is the network of automated telescopes located in different continents. It has a large FOV and quick response with high sensitivity to transient source at magnitude of 16 - 18 in Rmag in a minute exposure[4].

What I do with a mount of data?





Transient Source Search within Gravitational Wave Events

Kanthanakorn Noysena et al, Accepted abstract to poster presentation at Thai Student Academic conference (TSAC2018) in Brussels, Belgium during 18 – 20 May 2018

Gravitational waves were detected many times in the past few years, but no transient electromagnetic source was reported in a merger of a binary black hole. We developed a simple and effective algorithm to detect a new source in an image against catalog of Gaia Data Release 1. Machine learning was used and designed to locate a new source in a very large image by matching coordinates between data and catalog resulting the angular distance which was used to identify a new source and later treated as a possible candidate. Algorithm was used on images taken by the TAROT telescopes obtained few hours to few days after nine-gravitational-waves triggers of a binary black hole merger. New source was detected as a candidate, but non-potential candidate was confirmed with photometry.

Keywords: *search algorithm, transient source, gravitational waves, TAROT robotic telescope.*

Reference

[1] B. P. Abbott et al. Observation of Gravitational Waves from a Binary Black Hole Merger. Phys. Rev. Lett., 116(6):061102, 2016.
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[4] A. Klotz, F. Vachier, and M. Boër. TAROT: Roboticobservatories for gamma-ray bursts and othersources. Astronomische Nachrichten, 329:275, March2008.

*All work have been done on Ubuntu operation and permission license; LibreOffice, Python packages, Latex, Gimp, Spyder, DS9, Aladin and other GNU general public licenses.