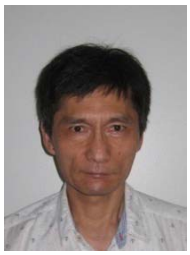
【Grant-in-Aid for Scientific Research (S)】

Science and Engineering (Mathematical and Physical Sciences)



Title of Project : Study of binary neutron star merger by high cadence optical observations

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Research Project Number : 16H06341 Researcher Number : 70211951
Research Area : Physics
Keyword : Astrophysics, gravitational wave, binary neutron star

【Purpose and Background of the Research】

The advanced LIGO (aLIGO), gravitational wave detectors in USA began to detect gravitational waves from celestial objects. If gravitational wave signals from a binary neutron star merger are detected, then it is expected that the electro-magnetic counter part could be detected and lead to better understanding of extremely dense matter in the neutron stars in addition to a test of the theory of general relativity.

【Research Methods】

In our study, we will develop an extremely wide-field camera loading a high sensitivity CMOS censor Tomoe Gozen1 (the field of view=9 degree, Tomoe in the following), and install it on the Schmidt telescope in the Kiso observatory of University of Tokyo. We will perform quick follow up observations of gravitational wave events by this camera aiming at the detection of the optical counter parts. In parallel with this preparation, we will also strengthen a system to analyze data from another gravitational wave detector KAGRA, which is now under construction in Japan and will operate in a few years.

From the theoretical point of view, we will construct models to predict and reproduce the optical counter parts emitted from binary neutron.

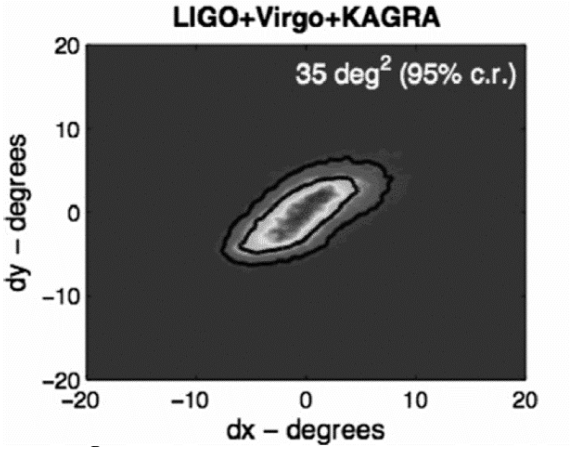

Fig. 1 Predicted localization of a gravitational wave source

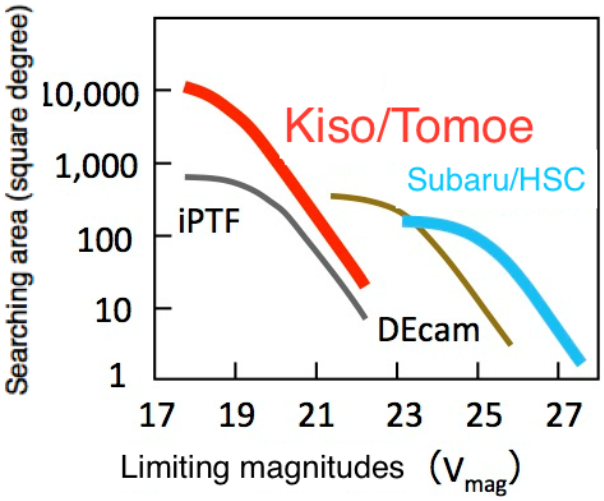

Fig. 2 Searching area achieved by one hour exposure as a function of limiting magnitude.

【Expected Research Achievements and Scientific Significance】

By comparing theoretical models with observational results thus obtained, we will deduce the chemical compositions, mass, and kinetic energy of the ejecta from a binary neutron star merger, which will constrain the properties of extremely dense matter in neutron stars. At the same time, we will explore the role of this kind of events as a source of elements heavier than iron.

【Publications Relevant to the Project】

・Sekiguchi, Y. et al. Physical Review D 91, 064059 (2015)
・Tsujimoto & Shigeyama, Astronomy & Astrophysics, 565, L5 (2014)

【Term of Project】 FY2016-2020

【Budget Allocation】 98,300 Thousand Yen

【Homepage Address and Other Contact Information】

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