Contribution ID: **655** Type: **Talk in the parallel session**

Efficiency of registration of chirp bursts and signals of collapsing stars by the Euro-Asian network of GW interferometers

Friday, 9 July 2021 08:50 (20 minutes)

In this report, we evaluate the performance of the proposed Euro-Asian network (EAN) of gravitational wave (GW) interferometers, which is planned taking into account the location of one of the detectors at the RAS Novosibirsk Scientific Center. EAN is formed by four detectors: VIRGO, KAGRA, LIGO India and Novosibirsk. The efficiency of this configuration is calculated based on typical numerical criteria for wide area networks (Raffai et al., Class. Quantum Grav. 30 (2013) 155004). One of the key criteria is the accuracy of reconstructing the parameters of GW bursts, which links the calculation of this criterion to a specific class of astrophysical sources. Previously, such calculations were performed for the “chirp” signals from the fusion of relativistic binaries. We are now adding estimates for signals from rotating collapsing stars at the “rebound” stages of the compression and bar-configuration formation process, preceding the final formation of the superdense remnant. The criterion of parameters, together with the criteria of polarization and localization, allows one to compare the integral efficiency of networks of various structures. As one of the important results, we find the optimal orientation of the Novosibirsk detector, which is specified by the angle between the south direction and the bisector of the Michelson arms of the GW interferometer. Comparison of the efficiency of EAN with two reference networks (HLVK, HLVI) when receiving “chirp” signals as well as signals of collapsing stars is performed. In the latter case, only sources within the Galaxy are taken into account; therefore, the averaging is performed over the celestial coordinates of the Milky Way. Numerical integration shows that the EAN predicts results comparable to known networks in reconstructing the polarization and source parameters. However, the EAN copes somewhat worse with the source localization criterion, since all EAN detectors are located on the same Euro-Asian continent.

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Session Classification: Sources of Gravitational Waves

Track Classification: Gravitational Waves: Sources of Gravitational Waves