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"...physicists have been obliged by the facts to bring down from the Olympus of the *a priori* ...(the concepts of time and space)...in order to adjust them and put them in a serviceable condition..."

Albert Einstein.

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Physical principles of gravitational waves detection

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In general it is possible to offer classification of gravitation antennas (GA) on methods of registration of gravitation waves (GW), whose basis is made by the principle of space forming of the metrology channel: on the surface of the Earth, in the near-earth space within the limits of the Solar system, on a cosmological scale. Accordingly it is possible to term common classes GA as ground GA, space and astronomical ones (fig.1).

In the first class there are GA implementing the methods of registration GW, in which the influence of GW on the measuring channel is carried out within the limits of the engineering device or system of devices located on the surface of the Earth.

Most known of this class are resonance GA, and also GA on free masses and rotation GA. As the development of the given method of registration GW it is possible to consider the proposal to create GA of a spherical construction permitting to receive the greater cross-section, and consequently, the efficiency of conversion of GW energy in acoustic oscillations.

The usage of an optical interferometer with coherent optical pump for registration of gravitation waves for the first time was offered by M.E.Gertsenshtein and V.N.Pustovoit in 1962.

The construction of laser interference gravitation observatories (LIGO), possessing the base of about several kilometers and high responsivity, is carried on in a number of foreign centres of science. Part of the projects is created under the scheme of a Michelson interferometer, the arms of which contain resonators Fabry-Perot (RFP), which are convenient at customization, have a low level of a dispelled light and optical resonance properties.

The schemes of multi-beam gravitation antennas with introduction of an additional semitransmitting mirror before a photodetector have been researched, the method of untuned recycling of light energy and synchronous recycling, the scheme of double recycling have been offered in a series of works .

The methods using quantum non disturbing measurements belong to number of common methods of a heightening of responsivity, in which the interferometry of quantum states is implemented. These methods are usable both to GA of a construction of the Weber and to LIGO.

To combined GA include antennas implementing effect GW at once on two degrees of freedom. As a rule, these methods rise the reliability of selection of a signal on a background of noise. As the example LIGO can be specified on, free masses of which are fulfilled as cylinders of Weber, that allows to compare outcomes

both interferometric, and resonance systems of registration to reduce influence of a thermal noise.

The antennas realizing registration of a variation of distance between trial bodies at the distances about the sizes of the Solar system are related to space GA. The major sizes of such antennas allow to register low-frequency GW, having rather high amplitude.

Space antennas include: GA registering signals on measurement of time of distribution of an electromagnetic signal up to the space flying apparatus, GA on Doppler tracing the space flying apparatus and laser space interferometric GA.

The astronomical methods of registration of gravitation radiation are divided into three basic groups: methods on the basis of tracing electromagnetic radiation transiting in the field of strong GW, methods on the basis of tracing astrophysical objects changing the properties near a GW source, and also methods on the basis of change of radiant properties of atoms in the presence of GW.

The first group includes the methods grounded on the effect of an angular variation of a direction on a star at transiting GW, effect of a delay of the map of objects behind a gravitation lens, the influence of GW on a background of microwave electromagnetic radiation, effect of an alternation of a position of a star owing to transiting electromagnetic radiation near to a GW source.

To the second group it is possible to refer the methods constructed on the effect of change of frequency of binary stars driving by a spiral at the effect of GW, the effect of GW on a spinning neutron star.

The methods included into the third group are on the basis of effect of change of frequency atom of hydrogen radiation of near a GW source, the change of a transition probability of redbergs atom into a GW field and amplification of electromagnetic radiation from stars transiting through a maser cloud at a displacement of a transition frequency of reradiating atom by a gravitation wave.

The enumerated methods of registration of gravitation radiation have different degrees of theoretical and engineering study. Some of them (for example, astronomical) depend on the influence of Earth's atmosphere on transiting of electromagnetic radiation and require taking the equipment out of the limits of the atmosphere. Part of the methods can be implemented in existing or created GA, such as LIGO, VIRGO, LIZA etc.

As a whole most perspective, on the one hand, and technically provided - on the other hand, it is possible to term the LIGO projects, being at the stage of constructions, and possessing resource of responsivity.

The given type of broadband GA contains a lot of possibilities according to the methods of holding of GW registration, methods of selection of signals, usage of quantum non disturbing measurements, inclusion into combined GA and in a GA web.