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Laser light perturbation by directional signals

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Abstract Similar and coincidental signals at a particular frequency were recorded simultaneously from two or three optical sensors piloted by a laser diode at distances up to hundreds of kilometers. Some of the signal's forms repeat at approximately the same time over the course of a two to three day period. This paper presents and discusses the data collected during a long period of observation (from October 2005 to January 2008). Studying the symmetry of the time series plot, three particular directions of the incoming signals were identified: RA 15h 35m ± 10m, RA 17h 22m ± 40m and RA 23h ± 40m. These three directions (if using only the RA coordinate) point respectively to the Great Attractor zone, to an area close to the center of the Galaxy and to the area opposite to the Virgo Cluster. In order to explain the observed phenomena a few hypotheses have been formulated and interpreted. It is remarkable that the directions detected in our experiment are in agreement with the estimates quoted in literature. A new possible mechanism explaining the laser light fluctuations was finally identified and a naive model based on this mechanism was developed in order to find out not only the AR coordinates of the sources but also their declinations. The results of this analysis confirm the quoted directions.

Keywords general, gravitational waves

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1 Introduction

Quite regularly in the last 30 years (see [1]and reference therein), several articles have appeared where the use of a laser as an active part of gravitational

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wave detectors is suggested. The working principles of such hypothetical detectors are various. For some of them ([1][2][3][4][5]and reference therein) it is possible that from the interaction between gravitational waves (GW) and electromagnetic waves further modes of oscillation in the cavity, previously unperturbed, may arise. In other devices it is reckoned that the space displacement induced by the GW over the positions of the cavity mirrors might also bring about changes in the intensity and frequency of the emitted laser light. Such hypothetical devices might be able to detect astrophysical phenomena emitting radiation in the frequency band ranging from the neutron stars and pulsar up to the supernovae. A few authors have suggested the possibility to produce and detect high frequency GW by such devices [6]. Gravitational optics has greatly developed, too: since Ohanian's early studies [7] on GW lensing we have come to theoretically discuss phenomena of GW diffraction and scintillation which, with the due differences, point out remarkable analogies with the wavy behaviour of the electromagnetic waves [8][9][10]. These new and hypothetical research techniques show limits deriving from the noise present in the laser cavities of the simple Fabry-Perot type or even in the more articulate ones; hence such devices require technologies de facto not yet available. The observation of strange fluctuations of the laser light in optical levers employed by me in the didactic laboratory suggested the idea that laser diodes, in spite of their minute size, could somehow give information about the GW flux incoming onto the earth. So, in October 2005, I started to carry out tests with laser diodes inserted in a systematic observation device. In this paper I will expose the results I got from data recorded during a long observational period using, at times, up to three detecting devices at once. Each device is made up of a laser diode pointing to a light sensor, which is hooked up to a personal computer that records the signal output voltage. The data show interesting fluctuations occurring occasionally and clearly over a long unperturbed period of time. Sections 5, 6, 7 and 8 are devoted to show a possible explanations of the observed phenomena by means of an heuristic new approach to the laser diode considered as active detector of gravitational radiation.

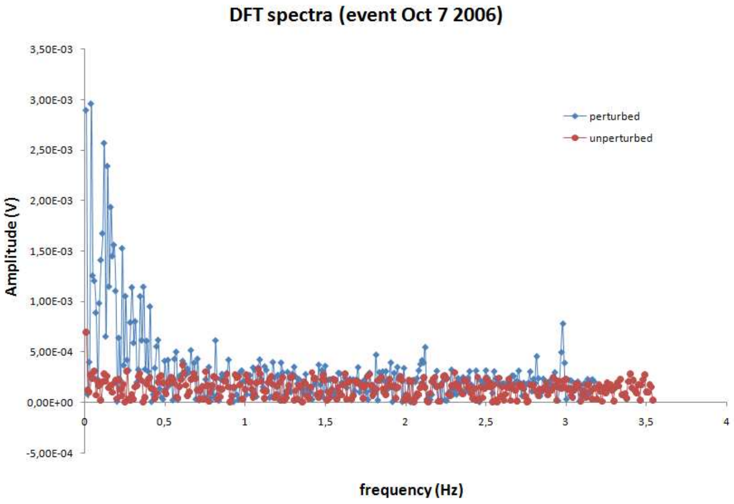

Fig. 1 DFT of data from a perturbed signal (blue) and a subsequent unperturbed signal (red), both of them recorded on October 6 2006

2 Technical specifications

This section is omitted in the present version

3 Results

Three particular directions were identified (see table 1):

1. RA 15h 35m ± 10m. This direction was present in 5 out of 12 cases. This meridian passes through the Great Attractor zone.
2. RA 17h 22m ± 40m. This direction was present in 2 out of 12 cases. This meridian passes through the center of the Galaxy. The ± 40m is due to the lengthy duration of the phenomenon.
3. RA 23h 40m ± 40m. This direction was present in 4 out of 12 cases. This meridian passes in the opposite direction of the Virgo Cluster. The ± 40m is again due to the lengthy duration of the phenomenon.

The graph in figure 2 represents the DFT amplitude at a specific frequency measured every 2 minutes on October 7^{th} 2006.

Both antenna A (green dots) and antenna B (red squares) were placed in the same room. These readings were taken while the antennae were aligned with the center of the earth and an area close to the center of the Galaxy. The shape reveals a typical diffraction signature (the blue line describes Fresnel's diffraction pattern calculated for the star cluster near the galaxy). Note that the DFT amplitude normally stays below -3.5 dB. More specific details and information are obtained from this graph and given in section 5.

The graph in figure 3 shows a burst detected by antenna A on two separate days, October 12^{th} and October 13^{th} 2005. The two plots are impressively

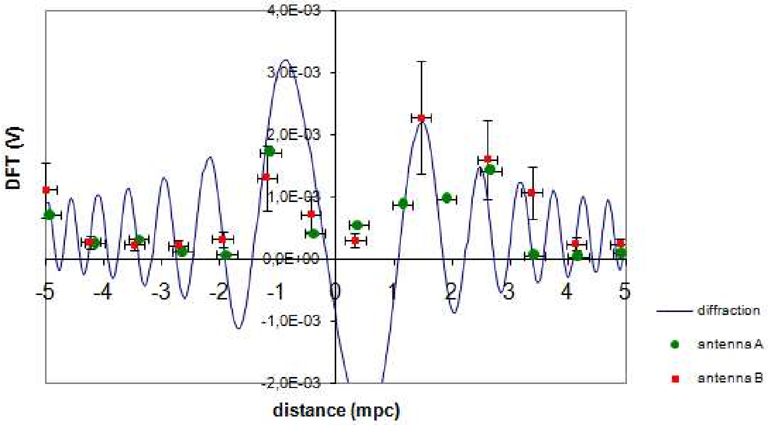

Fig. 2 DFT of the optical sensor output voltage measured every 2 minutes on October 7 2006 by antenna A (green circles) and antenna B (red squares) compared with the Fresnel diffraction plot found by Congedo & others [9]. As the PC of antenna B was slow periodically for two times it took it 3 minutes instead of two to record the DFT amplitudes

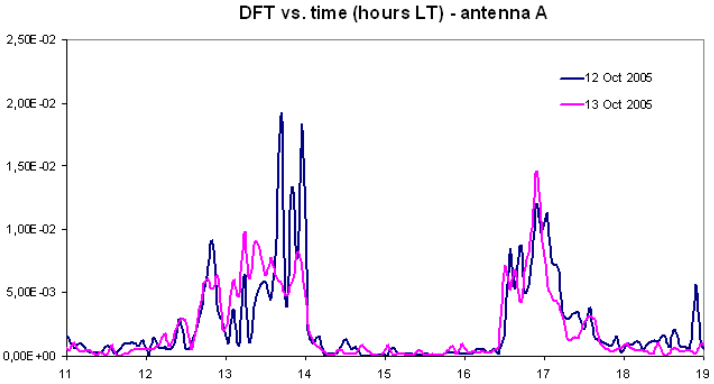

Fig. 3 Burst detected by antenna A on two days, October 12th and October 13th 2005. Values in ordinate are in Volts

similar. Unfortunately only one antenna (A) was operative during this time period. The figure 4 shows the data collected by the antennae called respectively A (blue) and B (pink) during November 3 2005. The two antennae were placed at a distance of about 12.5 km. The shapes of the two graphs are impressively similar. The graphs in figure 5, figure 6, and figure 7 show data recorded from antennae A (figs 5 and 6) and B on different months and days. It is possible to see an axis of symmetry (a black line) on all three graphs that point in the direction of RA $15^h 35^m$ regardless the varying times on

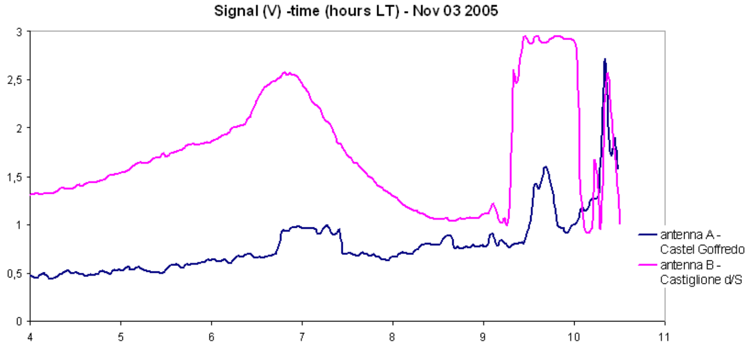

Fig. 4 Photodiode output voltage (Volts) vs. Local Time for the data collected by antenna A (blue) and antenna B (pink) during November 3 2005. The distance between the two antennae was about 12.5 km.

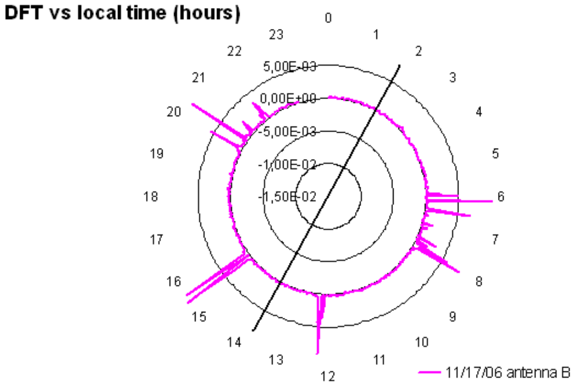

Fig. 5 see the caption in fig. 7

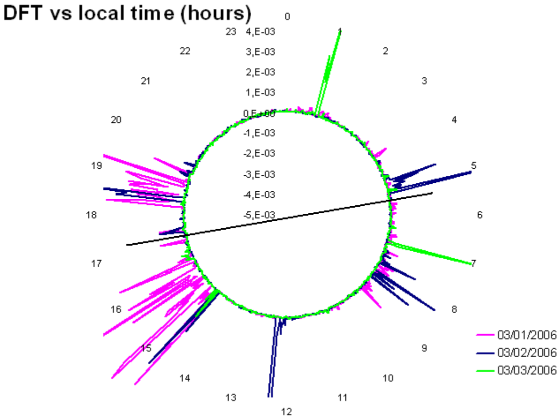

Fig. 6 see the caption in fig. 7

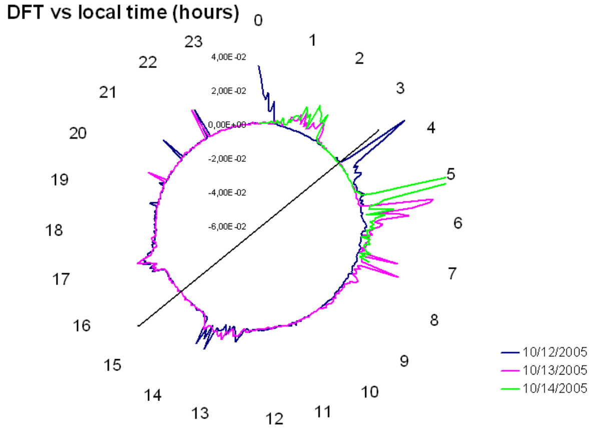

Fig. 7 Data recorded from antenna B (fig. 5) and A (fig. 6 and 7) on different months and days. It is possible to see an axis of symmetry (a black line) on all three graphs that point in the direction of RA 15^h35^m regardless the varying times on the graphs that represent the local times. Amplitude values are in Volts.

Table 1 Events detected

aligned point	Right Ascension RA ± 10^m (*) ± 40	local date and time of the event(Italy)	antennae involved positions: A,B,E 10^o 28' E long. 45^o 17' N lat. C 18^o 21' E long. 38^o 49' N lat.
SOUTH	15^h33^m	Oct.12-14 2005-15^h26^m	A
EAST	15^h36^m	Nov. 3 2005 - 7^h0^m	A B (12.5 km distance)
SOUTH	15^h37^m	Mar. 2 2006 - 5^h15^m	A
SOUTH	(*) 17^h22^m	Oct. 7 2006 - 17^h35^m	A B (in the same room)
SOUTH	(*) 23^h40^m	Nov 3-6 2006 - 12^h23^m	A B (in the same room)
SUN	15^h30^m	Nov 17 2006 - 14^h33^m	A B (in the same room)
SOUTH	(*) 23^h40^m	Jan 12 2007 - 16^h30^m	ABC (1000 km distance)
SOUTH	15^h42^m	Jan 28 2007 - 7^h30^m	A
NORTH	17^h42^m	Apr 15 2007 - 16^h45^m	ABC (1000 km distance)
SOUTH	23^h36^m	Jun 22-23 2007- 6^h38^m	A
SOUTH	16^h35^m	Oct 12 2007- 16^h28^m	B
EAST	$1.5^h \pm 1.0^h$	Jan 11, 18, 29 2008	E (laser diode)

the graphs that represent the local times. Some important remarks on directional analysis supporting a plausible explanation of the graphs 5, 6 and 7 are reported in section 7.

The table 1 summarizes all of the events from October 12th 2005 till January 29th 2008. The RA measurements suggest that one of the directions passes through the Great Attractor zone, another direction near the galaxy center and still another direction through the opposite of the Virgo cluster zone.

4 Motivation for a hypothesis

In this section and in the next one we will formulate some hypotheses about a particular observed phenomenon. However some general considerations need to be discussed. The environmental variables were not monitored. However in general we can exclude significant effects due to room temperature variations because the DFT analysis is unaffected by slowly varying physical parameters and local anthropogenic seismic noise. If the laser is made to work above the operative current as it is prescribed by the builders, no fluctuations appear and the light intensity of the laser is quite stable. The antenna was also tested without the laser and even in this case there was no noticeable disturbance. This fact excludes the possibility that the data logger interface (A/D and Basic program) considered as a stand-alone device, could have any effect. The device operated at room temperature and this one was completely uncorrelated with the macroscopic DFT amplitude variations. A comparison between spectra of perturbed signal and unperturbed one is represented in fig. 1. In fact the experiment was conducted all year long during all four seasons having the forethought to set the device so that the temperature changed slowly and could not produce any significant interferences to the DFT of the output signal.

The strangeness of the observed phenomena and the impossibility to explain them in a conventional way have prompted me to hypothesize that such interferences could be signals of extraterrestrial origin. After consulting a lot of the existing literature (see references from [1]to [10]) I realized that a laser diode, being a resonance cavity of the Fabry-Perot type, could be considered like an active detector of gravitational waves. Unfortunately the most optimistic article [1] hypothesizes a microwave detector made up of a cavity a few meters long in order to be able to detect the gravitational waves typically emitted by neutron stars.

A possible mechanism responsible for the effect can be heuristically found in the frame of a quantum version of the Weyl Theory as proposed in section 6. This mechanism could induce an electric field inside the cavity whose amplitude is wide enough to interact with the typical electromagnetic field of an unperturbed laser diode.

From another point of view it has been pointed out [3] that the interaction between GW and electromagnetic modes within a single mode laser turns into the appearance of two more modes. But the transition to chaos in solid-state lasers takes place precisely through the appearance of three modes or more as it has been verified experimentally [12]. So the idea is that the GW incoming onto the crystal of a laser diode, by inducing the appearance of two further, though feeble, modes of oscillation of the luminous radiation into the resonance cavity, brings about a transition to chaos, which we know is to appear even just for tiny induced variations of the parameters (the so called "butterfly effect") [12]. This is a way to explain the observations avoiding new physics. Of course the verification of both these hypotheses requires further in depth inquiry.

5 A hypothesis

Gravitational waves (GW) generate, like the electromagnetic waves, diffractive effects when they pass through slits or near objects. Figure 2 represents an excellent fit of the experimental data obtained from A and B antennae on October 7^{th} , 2006 in accord with the hypothesis that they follow the trend of the Fresnel's diffraction pattern produced by the star cluster lying near the galaxy center according to the analysis carried out by Congedo and others [8][9]. As a matter of fact in the just quoted literature, they consider the occurrence where a source of gravitational waves is set behind the star cluster in Sgr A*. The most famous star of such cluster, called SO2, was studied together with other stars of the same cluster by Ghez (see references in [8][9][10]). The blue curve in fig 2 represents the intensity of a hypothetical flux of GWs and was obtained by using as relative intensity

$$i_0(X_0) = 1 - (S(X_0) - C(X_0))\sin(k\delta) + (S(X_0)^2 + C(X_0)^2 - \frac{1}{2})(1 - \cos(k\delta)) \tag{1}$$

$$X_0 = x_0\sqrt{\frac{k}{\pi D}} \tag{2}$$

X_0 being a reduced variable of the position x_0 on the viewer's screen (in abscissa there is the real size of the diffracted beam at the distance of our planet). S(x) and C(x) are Fresnel's integrals, k is the wave number, assumed the incoming GW as monochromatic, of the radiation which gets to the diffraction screen, δ is the average distance among the stars of the cluster, and D is the distance between the diffractor screen and the viewer. To get δ in the quoted writings Plummer's model is employed, which describes the distribution of the stars in clusters of the same type as that analyzed by the authors (details in the quoted references).

We will consider the case when the GW source is a star of the star cluster itself or close to the cluster, for instance, a neutron star (NS) rapidly rotating and endowed with a peculiar speed having v as a component perpendicular to the source-viewer direction (the NS number has been estimated of the order of several thousands, considering only our galaxy [9]). Let us look at figure 8 which describes Plummer's distribution for a cluster of 560 stars. This case is particularly suitable for the analysis of Fresnel diffraction, as the source (circle) is relatively close to the diffraction screen (line). Let us assume, in other words, that the gravitational radiation comes from nearby the black hole at the centre of our Galaxy (GC or Sgr*A)[1]. If the source moves at a certain angular velocity, also the diffracted radiation beam will have the same angular velocity and so the same beam will "hit" the viewer (the earth) at a much higher speed than that of the source and obtained

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[1] Note that the highest peak of the diffraction plots in fig.2 lays at RA 17h 22m but the position of Sgr A* is approximately RA 17h 45m. The whole phenomenon has a duration of about 40m and the direction of the radiation is off by a few degrees. This fact could be explained by means of the argument exposed in the section 7 of this paper.

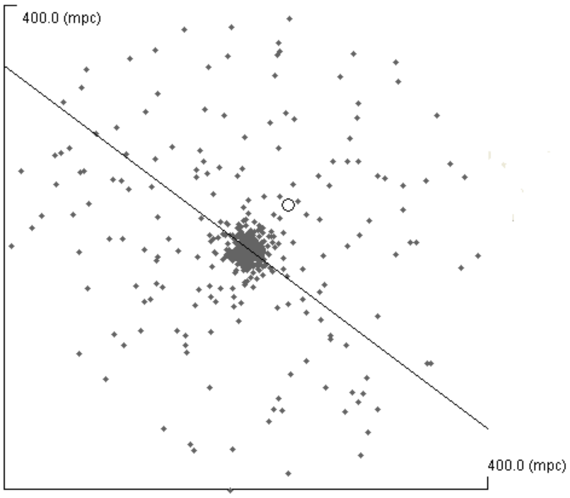

Fig. 8 Plummer's distribution for a cluster of 560 stars. The line describe the section of the diffraction screen and the circle the related source

by similitude. From the measures shown in fig. 2 we can get an estimate of the speed of the source as a function of its distance from the cluster center . Let's hypothesize, then, that the source is a pulsar having its own standard frequency, that is 40 Hz. Let's fix, then, the Fresnel diffraction limit on the GW frequency:

$$f \geq \frac{cD}{2\pi\delta^2} = 37 \cdot \left(\frac{D}{8 \cdot 10^3 pc}\right) \left(\frac{\delta}{10 \cdot r_c}\right)^2 Hz \tag{3}$$

being D the distance between the diffraction plane (passing through the cluster center) and the viewer's plane, and $r_c \sim 5.8mpc$ is the radius of the periaster of SO2 considered as the radius of the core of the star cluster [9]. The distance between the main peak and the absolute minimum in the diffraction figure is equivalent to the distance $X_0 = 1$ and so from 4.2 the actual distance turns out to be, on the viewer's screen,

$$\varDelta x_0 = \sqrt{\frac{D\lambda}{2}} \simeq 1 \cdot \left(\frac{D}{8 \cdot 10^3 pc}\right)^{1/2} \left(\frac{\lambda}{7.5 \cdot 10^3 km}\right)^{1/2} mpc \tag{4}$$

From simple geometrical considerations we infer that the v component of the source speed in the non-relativistic limit and dependent upon the distance d between source and diffracting screen turns out to be

$$v = \pm v_0 \frac{d}{D} + \sqrt{\frac{\lambda}{2D}} \frac{d}{T} \simeq 750 \cdot \left(\frac{40Hz}{f}\right)^{1/2} \left(\frac{8.0 \cdot 10^3 pc}{D}\right)^{1/2} \left(\frac{d}{10 \cdot r_c}\right) \frac{km}{s} \tag{5}$$

where f is the frequency of the GW, v_0 is the component of the speed of the earth perpendicular to the GC-viewer direction and $T \sim 5$ minutes is the time required by the beam to cover the distance x_0. The estimate of the NSs lying behind the galaxy center is of the order of several thousands [13] and notably a candidate (named Cannonball) was found near Sgr A* at a velocity about $v \sim 455 \div 912\ kms^{-1}/sin(\beta)$, where β is the angle between the line of sight and the actual travelling direction of the Cannonball [14]. All this sounds coherent with the framework I presented.

6 On a possible mechanism explaining electromagnetic field induced by gravitational waves in a laser diode

The interaction between electromagnetic modes and GWs in a cavity (even a laser beam) has been considered in literature by several authors as already pointed out. Our aim is to discuss a new physical process may be responsible for the transformation of GWs in electromagnetic waves in the quantum limit in a laser cavity. The term "transformation" emphasize Weyl's point of view [19] on unifying theories so different from Einstein's (and contemporary) philosophy. Weyl was deeply persuaded that gravitational field and electromagnetic field A^μ could be joined together by means of the following (gauge) relations

$$A'_\mu = A_\mu + \phi_{,\mu} \qquad , \phi = ln(\lambda) \tag{6}$$

where λ is a scale factor appearing in the famous relation defining the Weyl length

$$l'(x^\alpha) = \lambda(x^\alpha) \cdot l \tag{7}$$

and in the original formulation of his theory the metric was described by the relation

$$g'_{\mu\nu}(x^\alpha) = \lambda(x^\alpha) g_{\mu\nu}(x^\alpha) \tag{8}$$

Weyl's hypothesis imply that lengths are in general no longer integrable amounts. In order to bypass this difficulty London [20] interpreted the Weyl length as the wave function in his quantum version of the Weyl theory. Here we propose a different definition involving the weakly perturbed (complex) metric by means of the following relation

$$g_{\mu\nu} = \eta_{\mu\nu} + e_{\mu\nu}[\cos(k_\alpha x^\alpha + \psi) + i \cdot sgn(\sin(k_\alpha x^\alpha + \psi)) e^{\omega \int A_\alpha dx^\alpha}] \tag{9}$$

where i is the imaginary unit, *sgn()* is the sign function, $\eta_{\mu\nu}$ is the Minkowsky tensor, $e_{\mu\nu}$ is the polarization tensor in the so called TT-gauge of the standard General Relativity Theory (GRT) and ω and ψ are two constants that we will define later. Notice that the standard perturbed metric differs from the metric (9) because of a phase factor so that the real parts of both the metrics are the same. This phase factor is

$$e^{\omega \int A_\alpha dx^\alpha} = |\sin(k_\alpha x^\alpha + \psi)| \tag{10}$$

Hence the 4-potential can be wrote as

$$A_\mu(x^\alpha) = \Big(\frac{e}{\alpha}\partial_{ct}\ln(|\sin(k_\alpha x^\alpha + \psi)|), \mathbf{A}\Big) \tag{11}$$

Where α is the fine structure constant, ω is the the elementary charge to fine structure constant ratio. In particular we can choose the z axis as the direction of propagation of the GW and then we obtain the transversal electric field (that is perpendicular to the z axis)

$$E_x = \partial_0 A_x - \partial_x A_0 = \frac{e}{\alpha}\left(\frac{k}{\sin(k_\alpha x^\alpha + \psi)}\right)^2 \tag{12}$$

Now we introduce the quantum relation defining the wave number k as

$$k = \frac{\epsilon}{\hbar c} \tag{13}$$

Where ϵ is the energy of a single monochromatic GW (graviton). Hence the energy W of the incoming GWs in the cavity in the time t is

$$W = n\epsilon = W_g A \varDelta t \tag{14}$$

Where A is the surface area of the crystal and W_g is the flux of the incoming GW [3][4]

$$W_g = \frac{c^3\omega^2}{8\pi G}h^2 \tag{15}$$

h is the GW strength and ω is the pulsation of the monochromatic GW. The instantaneous induced electric field in the cavity is

$$E = \lim_{\varDelta t \to 0}\frac{e}{\alpha}\left(\frac{4\pi^2 c^3\omega^2 h^2}{8\pi G}\right)^2\left(\frac{A\varDelta t}{\hbar c}\right)^2\left(\frac{1}{\sin(\omega\varDelta t)}\right)^2 \tag{16}$$

The calculation provides for the case of a typical laser diode the relation

$$E \approx 4\cdot 10^{96}\left(\frac{f}{0.14Hz}\right)^2\left(\frac{A}{1mm^2}\right)h^4 \tag{17}$$

and because the electric field inside a laser diode AlGaInP in the operative regime is typically

$$E \approx 2\cdot 10^6 \Longrightarrow h \approx 10^{-23} \tag{18}$$

then, considering the the case treated in the section 5, this value is just below the present sensitivity threshold of the terrestrial bar detectors and interferometers like LIGO and VIRGO. It is easy to verify that the induced electric field (16) is really much smaller than the electrostatic field produced by electric charges and nuclei at atomic scale, then the perturbation inducing the electric field (12) do not introduces significant effect in the ordinary matter.

So we can consider the electric field (12) as a real effect appearing in the cavity. It should interact with the normal lasing electric field inside the cavity and then producing the observed perturbation of the light intensity.

7 A few remarks on the directional analysis

In the papers [3] and [4] Kolosnitsyn deduced an interesting relation describing the sensitivity of a GWs detector of the same kind I used as a function of the equatorial coordinates. In the lab system we can use the azimuth φ_0 and the co-latitude θ_0 obtaining the relation

$$f(\phi,\theta) = \frac{1}{2}\left(h_+ \cos^2\theta\cos^2\phi - h_+ \sin^2\phi + h_\times \sin 2\phi\cos\theta\right)^2 \tag{19}$$

where h_+ and $h_\times$ are the ordinary polarization amplitudes in the TT-gauge. However this function is valid only when the direction of the incoming radiation is perpendicular to the terrestrial axis. In our case the plane of symmetry of the crystal has been set horizontally or vertically in the north-south direction so the sensitivity function (19) should be multiplied by a factor taking into account the co-latitude and the longitude of the laboratory. In the case when the crystal is set horizontally we multiply the (19) by the following function

$$\mathbf{n}_{lab} \cdot \mathbf{n}_g = \sin\theta\sin\theta_0\cos(\phi-\phi_0) + \cos\theta\cos\theta_0 \tag{20}$$

being $\mathbf{n}_{lab}$ and $\mathbf{n}_g$ unit vectors defining the direction perpendicular to the crystal and the direction of GWs respectively.

In the figure 10 we find three of these functions relative to three different points in the sky (labeled by their co-latitudes in the graph). The shape of this function for different polarization amplitudes and different co-latitudes is described in the plot of fig. 9 (as an example $h_+ = 1$ and $h_\times = 0.5$ for all the plotted function). This function reveals the reason why in fig 5-7 we observe apparently different axis of symmetry. In fact the relative maxima and minima of a single function are not periodic of period π so that the discrepancy from the positions of two axis of symmetry can reach an amount even of an hour of RA or more. This fact provides a possible explanation of the circular plot in fig. 5-7. The counting of the events recorded by the antenna A during the year 2007 (282 of 365 days) was performed considering only the events with a DFT amplitude higher than 0.005 volts.

The events counted for a given RA are plotted in fig. 10 (green dots). In the plot we can see the anisotropy of the distribution. In order to obtain the declinations of the hypothetical sources of the signal detected by antenna A, three sensitivity functions for three initially arbitrary directions was plotted and then their declinations and AR was adjusted in order to obtain a superposition that is sum of the three sensitivity functions (black curve in the plot) with a minimum χ^2 statistic value. The χ^2 goodness-of-fit test provides a value just below the critical one for a 5% confidence level. Hence we can accept the hypothesis of directional GWs within a 1% confidence level. The results are reported in the tab 2. The results obtained by the fit harmonize (considering only the RA) with that obtained by the burst symmetry. The three direction detected are in agreement with the Galactic Center zone, the Great Attractor zone and the Virgo Cluster respectively. Unfortunately because of the wide uncertainties of the measures we can interpret the results only as roughly estimates.

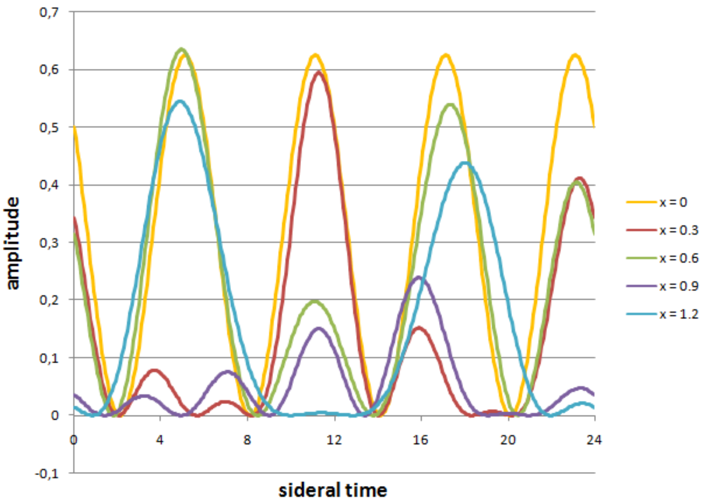

Fig. 9 plot of the sensitivity functions relative to different co-latitudes (x) of the lab system

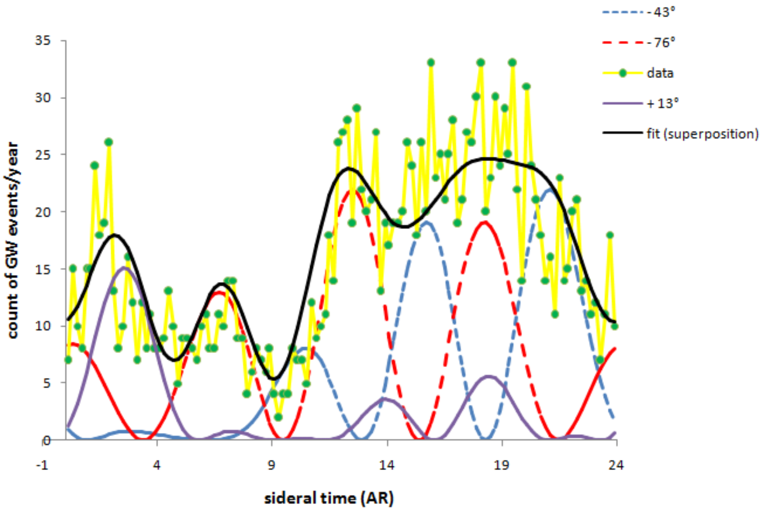

Fig. 10 Comparison between the fit (black line) and the number of events revealed by antenna A beyond the 0.005 V threshold as a function of sideral time during the year 2007. The three sensitivity functions are related to the Galaxy center (-43^o dec), to the Great Attractor (-43^o dec) and to the Virgo Cluster ($+13^o$ dec) respectively

Table 2 Directions detected

FIT RA	 dec.	BURSTS RA	 dec.	POSSIBLE OBJECT (*) opposite direction
$17.0^h \pm 1.5^h$	$-43^o \pm 23^o$	$17.4^h \pm 0.7^h$	ND	Galactic Center
$13.9^h \pm 1.5^h$	$-75^o \pm 23^o$	$15.58^h \pm 0.17^h$	ND	Great Attractor
$22.9^h \pm 1.5^h$	$+13^o \pm 23^o$	$23.7^h \pm 0.7^h$	ND	Virgo cluster (*)

8 Conclusion

This paper provides some observational evidence of the existence of some kind of radiation coming from particular directions. The fluctuations of the laser light intensity are macroscopic because of the high SNR even at room temperature. Though working between the laser threshold and the operative threshold, the laser is only affected by the 1/f noise, which is by its nature stationary. As these signals easily stand out from the background noise and, above all, considering that, where the impulses recur in the space of two or three days, they show a space distribution featuring a certain symmetry (see figures quoted above), we thought of considering them as signals coming from non-terrestrial sources. As there are several articles dedicated to the survey of gravitational waves through resonance cavities (including lasers) [1][2][3][4][5], we thought that, in some way or other, the lasers used in this experiment may have revealed signals influenced by the gravitational radiation flux produced by astrophysical processes. Of course such hypothesis must be further investigated by experiments, both more accurate and distributed on a larger scale; however, it is remarkable that the directions of the revealed coincidences shown by the axes of symmetry harmonize with what has been theoretically reckoned ([16]-[19] and in particular [18]).
In particular I tried to give a possible explanation of an event, in terms of the detection of gravitational waves being detected after being diffracted by the star cluster surrounding the Sgr A* massive black hole (MBH) as suggested by Congedo and others [11]. The results obtained from the measurements agree with those predicted. The time displacements of bursts permit only a partial directional analysis, the right ascension, because the declination is missing (see fig. 4, 5, and 6). The situation is different if we analyze the distribution of the count of the events that occur in a given sideral time instant (fig. 10). In fact such a distribution shows a clear anisotropy. Even though there are other articles (see [1]-[5]and reference therein) about GW in a resonance cavity, the calculations provided by the authors are not nearly enough to explain the fluctuations in our experiment. However under the hypothesis that the mechanism responsible of the fluctuations of the laser light is related to the interaction between e.m. radiation and GWs inside the laser in the framework described in section 6 we can heuristically explain all of the observed phenomena. As a matter of fact a best fit modelling the plot of the event count and built under the hypotheses above allow us to deduce results (sources coordinates) that agree with the estimates obtained considering the bursts symmetries and the real positions of the sources statistically more

significant (GC, GA and Virgo cluster). Moreover a different mix of the two kind of polarized radiation explains the reason why there are deviation from symmetry in the plots in fig. 5-7. A further consideration emerges processing data regarding polarizations: it seems that each one of the bursts has a prevalent polarization state of its own, whereas if we consider the event count, both of the two possible polarization states are equally present and this fact is statistically correct.

The new approach considered in section 6 when combined with the quantum relation of the Casimir force [11] between two plates (crystal gates) provides interesting estimates of the GWs strength in accordance with the typical intensity of the radiation incoming from Neutron Stars (calculations are not reported here). Anyway an estimate of an upper limit to the strength of the detected radiation performed in section 6 explains the reason why interferometers like LIGO or VIRGO cannot detect these bursts yet. However, some of the hypotheses used in this work need further theoretical elaboration and experimental tests, to which I will devote further attention. Moreover further experimentation is needed and at present a second European and larger scale experiment is about to be conducted using a network of antennae placed farther away from each other. I hope and I look forward to the participation and discussion by the community of physicists. I'm extremely grateful to my friend Enzo Campion for his technical and engineering support and to Silvio Bergia for his constant advice and encouragement.

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