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The frequency 104 μHz in the orbital motion of close binary stars

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Abstract. According to General Relativity, a stellar binary generates gravitational waves at a primary frequency twice the orbital one; these waves however have not yet been detected. If the Universe contains gravitational radiation at discrete frequency(ies) – particularly with the period of 160 minutes discovered in the 70-th in the Sun, corresponding resonances might be found in the distribution of orbital frequencies of binaries. With this in mind, we analyse all available data on orbital frequencies of close binaries of the Galaxy. In the frequency range 5 to 160 μHz, we find one significant frequency $\nu_0 \approx 104.2$ μHz – at the 4σ confidence level –which modulates the distribution of about 5000 binaries with periods $P < 5.5$ d. The corresponding "resonant" period, 160.0 ± 0.5 min, coincides with that of solar pulsation $P_0 = 160.0 \pm 0.5$ min. The question on its origin and also the hypothesis of a cosmological nature of the P_0 oscillation are briefly discussed.

Key words: Sun: oscillations – stars: binaries: close – gravitation

1. Introduction

The possibility of gravitational waves has been known for a long time, but they have never been observed.

The possible sources (or detectors) of gravitational radiation (GR) are only of quadrupole character and have, therefore, very small effectiveness (this is also due, of course, to the very small value of the specific gravitational charge; see, e.g., Braginskij 1965). Over the last three decades theoreticians and experimentators have often considered stellar binary systems with short orbital periods P and large masses $M \sim M_\odot$ amongst the most favourable sources of extraterrestrial GR. For a binary, the radiation is emitted at a fundamental frequency equal to twice the orbital frequency $\nu = P^{-1}$, and also at higher harmonics – from the third (for eccentricity $e = 0.5$) to the tenth (for $e = 0.7$) (Press & Thorne 1973). The GR background from binaries in the Galaxy might exceed that of cosmological origin at frequencies $10^{-2} - 10^6 \mu$Hz (Sazhin 1978; Lipunov & Postnov 1987).

The inverse situation must also be considered: if GR, or, perhaps, quasi-GR (QGR), is present at some discrete frequency(ies) it could produce an observable effect on close binaries. This hypothetical monochromatic GR or QGR, might be of a relic of early stages of the Universe, or due to a mutual quasi-gravitational resonance between short-period binaries themselves; see also below. We propose to use the statistics of periods of the entire sample of close binary systems (CBS's) is proposed to be of interest as a test for the existence of monochromatic gravitational waves (GWs) (or quasi GW's) in the Universe.

2. Binaries as GR detectors

The action of GWs on binaries is of course rather small, but – for a given binary – it might be accumulated over substantial part of its life-time T. We propose to use binaries as *resonant mechanical systems*. They are supposed to "remember" the long-time action of GW's (operating in the Galaxy or/and Universe over time intervals $\sim 10^7 - 10^9$ yr, may be since the beginning of the Universe.

Therefore, the distribution of orbital frequencies of binaries might exhibit – in a statistical sense – the integrated effect of a hypothetical "universal" GR (QGR). While this effect cannot be seen directly as periodic variations of binary frequencies, because too many cycles would need to be averaged to overcome observational noise. We conjecture in this paper that the distribution of orbital frequencies of a sufficiently numerous sample of CBS's might exhibit a deficit or excess of binaries at some definite frequency(ies) being connected via simple resonant relations with frequencies of the hypothetical GWs (or QGWs).

3. The method of analysis

A first method could be to check commensurability in the periods of binaries. According to Goldreich (1965), two frequencies, ν_1 and ν_2 ($\nu_1 > \nu_2$), are thought to be quasi-commensurate with each other if

$$| \frac{\nu_1}{\nu_2} - \frac{n_1}{n_2} | = \epsilon, \tag{1}$$

where n_1 and n_2 are small integers and $\epsilon \ll 1$.

However in the present paper, following the Kotov & Koutchmy's (1985) approach, we shall compare rates ν_i of various objects with running frequency ν, which will vary within a given frequency range; i is the ordinal number of i-th object; $i = 1, 2, ...N_O$ where N_O is the total amount of objects in the sample. If there is a frequency which shows a significant minimum of deviations of the ratios ν_i/ν (or may be ν/ν_i) from an integer number, it will be near-commensurate with the rates of the total sample of objects.

To search for the resonance (or: near-commensurability) inside the sample of galactic binaries, we introduce the following commensurability function (CF; see Kotov 1986):

$$F(\nu) = \frac{1}{\sigma_0}\{b - [\frac{1}{N_O}\sum_{i=1}^{N_O}[x_i - INT(x_i + 0.5)]^2]^{1/2}\}, \quad (2)$$

where $x_i = \nu_i/\nu$ if $\nu \leq \nu_i$, and $x_i = \nu/\nu_i$ if $\nu > \nu_i$; $b = 12^{-1/2}$ and $\sigma_0 = (60\ N_O)^{-1/2}$. By definition, the maximum of the $F(\nu)$-function corresponds to the best least-squares fit of the ratios x_i – of pairs of frequencies – to integers. Kotov (1986) has shown that for a random sample of ν_i-s the standard deviation of CF $F(\nu)$ equals one, and the $F(\nu)$-values themselves are normally distributed around zero.

Further, by analogy with usual power spectrum (PS) analysis, we define the commensurability spectrum

$$F_0(\nu) = F(\nu) \mid F(\nu) \mid, \quad (3)$$

which, contrary to usual PS, takes into account also the sign of the CF: a positive (negative) value corresponds to a case of commensurability (non-commensurability).

One must realize that for an external GR (QGR) a binary in fact must appear as a two-fold object: *(1)* it may be in some sense perceived as a single "rigid" or "quasi-rigid" body (like dumb-bells), – especially in the cases of ellipsoidal, contact and semi-detached binaries (e.g., those of the W UMa type, with intense transfer of matter between components), or *(2)* just as a pair of separate stars (practically not interacting, bound only by gravitation force). Accordingly, we conjecture that there might be also a two-fold effect of a potential GW (QGW) of external origin (which has, say, a primary frequency ν'): *(A)* a simple resonance at frequencies most commensurate with ν', and *(B)* complementary resonances at a frequency $\nu'/2$ and its integer harmonics.

The effects *A* and *B* however might be in opposite directions, if we consider the sign of $F(\nu)$. In the case of a "quasi-rigid" body (the *A* resonance) one expects an excess of objects with frequencies near-commensurate with ν' (for indications for a similar situation see, e.g. Gough 1983 and Kotov & Koutchmy 1985). But in case of *B* resonance one expects a lack of binaries with $\nu'/2$ and its integer harmonics, due to relatively rapid change of the binary period around this frequency(ies) caused by the gain of energy and angular momentum transferred by GR (or QGR). In other words, one may expect to find an excess of binaries with frequencies $\nu \approx \nu'/Z$ and $\approx Z\ \nu'$, and also a lack of binaries with frequencies $\nu \approx \nu'/(2\ Z)$ and $\approx 2\ Z\nu'$, where Z is a positive integer.

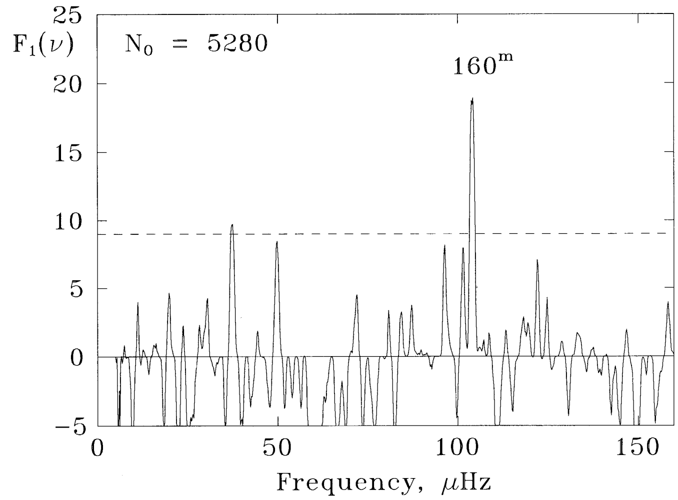

Fig. 1. The generalized commensurability spectrum $F_1(\nu)$ computed for close binary stars of the Galaxy (with orbital periods $P < 5.5$ d; the total number of periods $N_O = 5280$). The dashed line indicates the formal 3σ level. The major peak corresponds to a period of $P = 160.0 \pm 0.8$ min, with nearly 4σ significance.

To sum up both effects, we introduce a generalized CF:

$$F'(\nu) = 2^{-1/2}[F(\nu) - F(\nu/2)], \quad (4)$$

with the corresponding spectrum

$$F_1(\nu) = F'(\nu) \mid F'(\nu) \mid . \quad (5)$$

A maximum of F_1 at some frequency ν'' will indicate, on the average, the presence of a *A* type resonance (simple commensurability) at frequency ν'' and its integer harmonics, and simultaneously of a *B* type resonance (non-commensurability, i.e. a deficit of objects) at frequency $\nu''/2$ and at its integer harmonics.

4. The data and "resonance" spectra

We analysed all available data on orbital periods of eclipsing and spectroscopic binaries with $P < 10$ d, taken from: i) the "General Catalogue of Variable Stars" with $N_O = 3745$ binaries, compiled by Kholopov et al. (1985-1987), and ii) four other catalogues due to Kopal & Shapley (1956), Batten et al. (1978), Brancewicz & Dworak (1980), Popova & Kraicheva (1984), with N_O = 80, 540, 962 and 518 binaries respectively. The total number of binaries (with $P < 10$ d, and an error in the period not larger than ± 0.005 d) is 5845.

The resonance spectrum $F_1(\nu)$ computed for all binaries with $P < 5.5$ d ($N_O = 5280$) is shown in Fig. 1 where we see a peak at a period of 160.0 ± 0.8 min (frequency $\nu = 104.2 \pm 0.5$ μHz; the uncertainties everywhere are 1σ); its formal confidence level $\mathscr{P}$ (C.L.) is nearly 4.4σ. Note that the chance probability p of this peak should not be multiplied by the number of independent frequencies tested, $m \approx 100$, since the period of the peak agrees within the error limits with

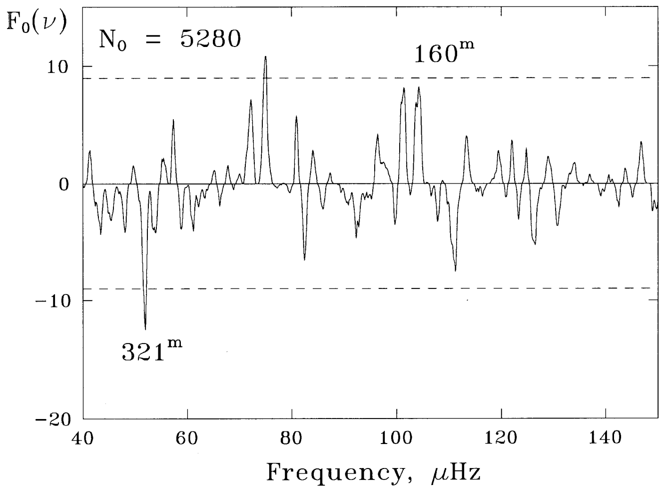

Fig. 2. The simple resonance spectrum $F_0(\nu)$ for 5280 orbital periods of binaries with $P < 5.5$ d. The dashed lines correspond to the formal 3σ level for positive (upper) and negative (lower) peaks of the $F_0(\nu)$-spectrum. The *A* and *B* type resonances are associated with positive ($\approx$ 160 min) and negative ($\approx$ 321 min) peaks located at frequencies $\nu \approx 104.2$ and ≈ 52.0 μHz, respectively.

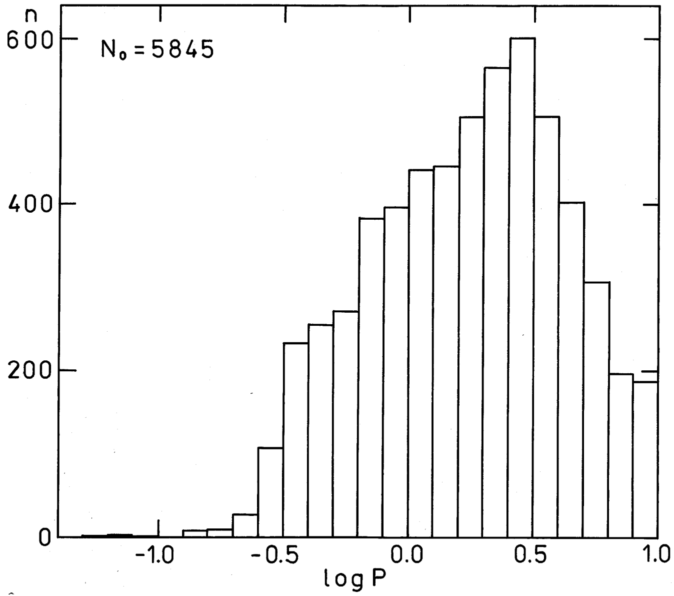

Fig. 3. The period distribution of CBS's with periods $P < 10$ d listed in five catalogues of binary stars (N_O = 5845; periods P are expressed in days).

a *a priori* period suggested by previous investigations (Brookes et al. 1976; Severny et al. 1976; Grec et al. 1980; Gough 1983; Scherrer & Wilcox, 1983; Kotov & Koutchmy 1985; Scherrer et al. 1993). This period also coincides with the "solar" value 160.0 $\pm$ 0.5 min (Severny et al. 1976), or, more correctly, with P_0= 160.0101 $\pm$ 0.0001 min (Scherrer et al. 1993). If we take into account the circumstance that there is some overlap between the five catalogues (for detailed discussion see below), – so that the true number of *different* binaries $N_O \approx 5000$, – the confidence of the peak (estimated using random numbers) is still found to be of 3.7σ. The probability of occurrence of the peak by chance is $p \lesssim 10^{-4}$. There is no other significant peak in Fig. 1 for the frequency range 5 – 160 μHz (in periods, from about 1.7 hr to $\approx$ 2.3 d).

One should also note that the period we have found is very close to the 1/9-th of a terrestrial day, suggesting the possibility of a mere observational artifact. This is ruled out by the following three arguments:

(a) the actual "solar" period deviates significantly from exactly 1/9-th of a day: P_0= 160.0101 $\pm$ 0.0001 min (1/9-th of a day is 160.0000 min),

(b) there is no other peak in the F_1-spectrum which could be closely related to any other harmonic of a day.

(c) the primary effect relates to the $\approx$ 320-min periodicity which is *non-commensurate* with a day.

It is interesting to know which of the *A* resonance or the *B*-resonance contributes most to the P_0-peak in the F_1-spectrum. To this aim we computed the simple resonance spectrum $F_0(\nu)$ – for orbital periods $P < 5.5$ d, i.e. for the same number of periods N_O = 5280; the result is plotted on Fig. 2. We observe a positive peak at frequency 104.2 $\pm$ 0.5 μHz (period P = 159.9 $\pm$ 0.8 min, at about 2.9σ) and a remarkable negative peak at frequency 52.0 $\pm$ 0.5 μHz (period 321 $\pm$ 3 min, at $\approx 3.3\sigma$). All other peaks have no relevance to the discussion: they might be real (but with low significance), or appear just by chance, with no noticeable correspondance in the generalized F_1-spectrum. One must conclude therefore that the strongest 160-min feature in Fig. 1 arises indeed from both resonance effects, *A* and *B*, as was supposed for the action of a hypothetical GW (QGW).

5. The main effect: an excess or deficit of objects

The majority of period data (Fig. 3) covers the ν-range from about 2 to 45 μHz, the main commensurability effect being found at $\nu_0 \approx 104.16$ μHz. However, because the $F(\nu)$-function determines a particular test frequency ν which has a near-integer relationship to entire sample of data, one might expect to see many other harmonics (ranging, say, from 3-d to 50-th) of ν_0 emerge in the resonance spectrum. The reason for the absence of those peaks (see Figs. 1 and 2) is the fact that at each test frequency the $F(\nu)$–function is determined by various contributions from the *total* set of frequency ratios x_i. If, indeed, a significant amount of objects exhibit a near-commensurability with frequency ν_0, the majority of deviations Δ_i for that frequency should be within the range 0.00 – 0.25; but, e.g., for the first overtone the substantially larger number of Δ_i-deviations will spread up to 0.50, – so that the lowest harmonic might already be blurred out, and of course even more the higher harmonics (equally, in frequency ν, or period P), for which Δ_i-values will be well randomized within the range 0.0 – 0.5. One should however note that some effect of harmonics might be still present in the real spectra, increasing thus the fluctuations of both $F(\nu)$ and $F'(\nu)$, – see below. This is similar to the influence of sidelobe structures on a power spectrum obtained unevenly-spaced data series; see, for instance, the discussion of the so-called quasi-persistency effect by Forbush et al. (1983).

When considering Fig. 2, one should keep in mind that a peak does not imply the presence of "excess" (or "lack") of objects at the corresponding frequency. For instance, the 104-μHz feature is not produced by an excess – say, by $\lesssim$ 100 – of binaries rotating with periods near 160 min, – as might be suggested from the vertical scale of Fig. 2. Any positive peak, according to (2), is determined as a matter of fact by a *tendency* of significant portion of objects to be near-commensurable, on the average, with a given period. The height of the $F_0(\nu)$-peak correlates with: *(a)* the relative number of near-commensurable objects and *(b)* the importance of that "tendency", i.e. with the percentage of data with deviations $\Delta_i < 0.25$, < 0.20, < 0.15 etc. (According to (2) and (3), the sizes of the $F_0(\nu)$-peaks in Fig. 2 vary approximately as the ratio N'/N_O where N' is the excess number contributing to a given "peak".)

Notice also that the Δ_i-values are evenly distributed between 0.0 and 0.5 for pure noise; the mathematical expectation of the squares of the deviations, i.e. the mean of $\Delta_i^2 = [x_i - INT(x_i+0.5)]^2$, is equal to $b^2 = 1/12$ (see expression (2) and Kotov 1986); consequently, the mean value of $F(\nu)$ is zero. Further, being normalized by the factor σ_0^{-1} = $(60\ N_O)^{1/2}$, it has a standard deviation of unity.

In Fig. 4 we plot the distributions of deviations Δ obtained for the $F_0(\nu)$-spectrum (Fig. 2) at both frequencies, 104.160 and 52.080 μHz, and for the $F_1(\nu)$-spectrum (Fig. 1) – at ν = 104.160 μHz. We conclude that the basic effect is due to:

(a) a near-resonance (*A* effect) with frequency ν_0 – of an excess of $N' \approx 100$ binaries ($\approx 2\%$; see Fig. 4a);

(b) a lack of about 100 binaries with periods non-commensurate with ν_0 (the same *A* effect, with nearly identical relative amplitude, $\approx 2\%$; see the same plot);

(c) a near-antiresonance (*B*-effect) of a roughly similar amount of binaries with respect to $\nu_0/2$ (in fact, according to Fig. 4b, an excess of $N' \approx 100$ binaries with $\Delta \approx 0.4$ to 0.5, and a deficit of ≈ 100 binaries with $\Delta < 0.25$).

The overall effect – the *A* and *B* resonances altogether, – as revealed by Fig. 4c, is due to *an excess* of about 200 binaries (when counting excesses of objects – in Fig. 4a,b – above the mean number of about 528 objects for each of the 10 bins). One can see, moreover, that about 200 *extra* binaries are tuned to *A* or *B* resonances within the relative limits of about 10% (or about 150 extra binaries – with an accuracy $\approx 5\%$). There is also a lack of about 200 binaries with $\Delta > 0.1$ with respect to both *A* and *B* resonances.

Three to five "peaks" in Fig. 2 have amplitudes comparable with that of the 104-μHz feature. An important fact is that none of those "peaks" has low-frequency satellites, unlike the 104-μHz feature which is "reproduced" by the remarkable 52-μHz negative satellite. This is also explicitly demonstrated by the $F_1(\nu)$-spectrum plotted in Fig. 1. The highest peak in Fig. 2, with frequency $\nu \approx 75$ μHz which is located near the middle of two peaks of interest, "160 min" and "321 min", might be an artifact due to the method of computations; in any case it has no correspondance in the main spectrum $F_1(\nu)$ shown in Fig. 1.

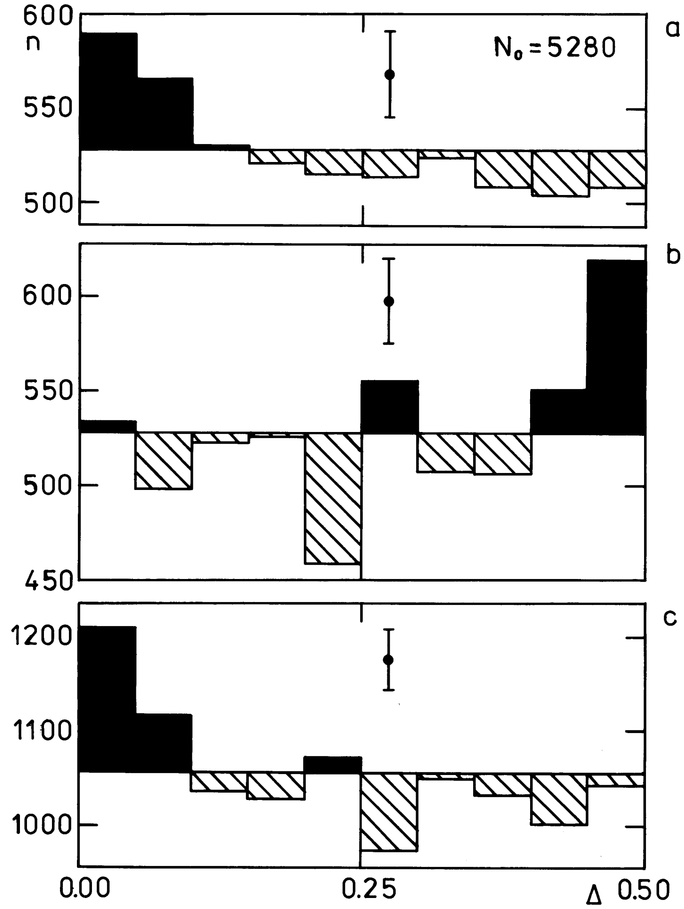

Fig. 4a–c. The distributions of deviations Δ, obtained for the $F_0(\nu)$-spectrum at frequencies **a** 104.160 μHz and **b** 52.080 μHz and **c** for the $F_1(\nu)$-spectrum at ν = 104.160μHz (see text for description). The total number of sample frequencies N_O = 5280 (for $P_i < 5.5$ d); the vertical bar indicates a typical $\pm 1\sigma$-uncertainty for each of ten bins ($\sigma \approx (5280/10)^{1/2} \approx 23.0$ for **a** and **b**, and $\approx (10560/10)^{1/2} \approx 32.5$ for **c**). To get the bottom plot *"c"*, Δ-deviations of the plot *"b"* were transformed to deviations $0.50 - \Delta$, then the new distribution was summed up with Δ-distribution of the plot *"a"*. Bins with an excess and lack of Δ-deviations are shown by black and shaded areas, respectively.

6. The test using random numbers

To make the above arguments more convincing, we repeated computations using 5845 random numbers – random "orbital periods" P_i', with a *log* P-distribution identical with the real one (Fig. 3). The spectrum $F_0(\nu)$ computed for 5280 random periods $P_i' < 5.5$ d is shown in Fig. 5 where no significant peak is present. In particular, we do not see any noticeable feature at the frequencies of interest, near 52 and 104 μHz.

The generalized commensurability spectrum $F_1(\nu)$ computed for those 5280 random numbers, is shown in Fig. 6; there is also no significant positive peak exceeding 2.3σ. Some negative peaks – in particular that at $\nu \approx 60$ μHz (with $P \approx 4.6$ h), see Figs. 1 and 6, – are thought to result from inhomogeneities of the P-distribution (Fig. 3) associated perhaps with observa-

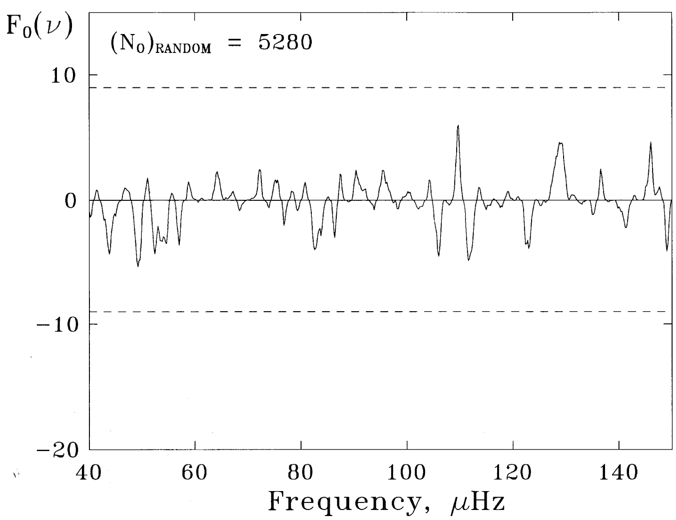

Fig. 5. The same as in Fig. 2, but computed for 5280 random periods $P_i' < 5.5$ d.

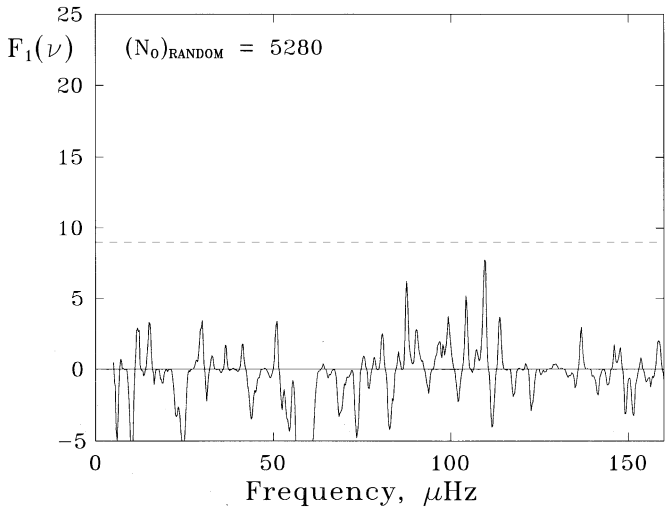

Fig. 6. The same as in Fig. 1, but obtained for 5280 random periods ($P_i' < 5.5$ d).

tional selection effects or physical properties of binaries. The fact that those peaks are negative, exclude a resonance effect at the corresponding frequencies. It is interesting that the negative peak ≈ 60 μHz emerges in both $F_1(\nu)$-spectra shown in Fig. 1 (real periods P_i) and Fig. 6 (fictitious periods P_i'). This must be attributed plausibly to relatively sharp variations in the period distribution (Fig. 3) which are identical for both samples.

The formal significance of a peak in the $F_0(\nu)$ or $F_1(\nu)$ spectrum, expressed in units of σ's of a normal distribution, is $\mathscr{P} = A_p^{1/2}/\delta$, where $A_p > 0$ is the peak amplitude of the "quadratic" spectrum $F_0(\nu)$ or $F_1(\nu)$, and δ ie the standard deviation of the corresponding function, $F(\nu)$ or $F'(\nu)$ (see expressions (2)– (5)). For pure noise, the standard deviation δ of both $F(\nu)$ and $F'(\nu)$ is 1.0 (Kotov 1986). The slight overlap between catalogues increases δ and therefore leads to a decrease of the ratio $A_p^{1/2}/\delta$ and thus to a decrease of $\mathscr{P}$. To overcome

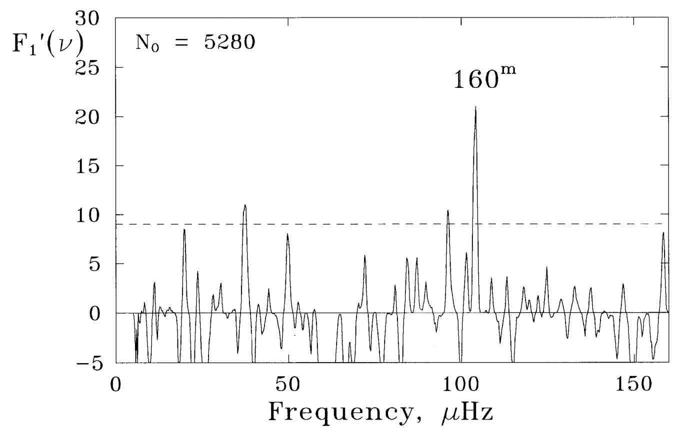

Fig. 7. The average resonance spectrum $F_1'(\nu)$ computed for five catalogues of CBS's (compare it with Fig. 1; see also text).

Table 1. The empirical δ-values obtained for 5280 sample periods $P < 5.5$ d.

Spectrum	Type of data	Figure	δ
$F_0(\nu)$	random	Fig. 5	≈ 0.99
$F_0(\nu)$	real	Fig. 2	≈ 1.12
$F_1(\nu)$	random	Fig. 6	≈ 1.13
$F_1(\nu)$	real	Fig. 1	≈ 1.19

this problem, we estimate empirical δ-values for each spectrum, $F(\nu)$ and $F'(\nu)$ being considered in sufficiently wide frequency ranges; the results are given in Table 1.

As expected, the empirical δ-value of random data in the $F_0(\nu)$ spectrum, agrees well with the theoretical value 1.00. The small increase of δ's for other three type of data might be easily explained by *(a)* a quasi-persistency of F_0- and F_1-spectra due to method of computation (via the potential presence of harmonics of "peaks") and *(b)* the overlap between catalogues (in the case of real data). Taking into account the entries of Table 1, the confidence level $\mathscr{P}$ of the main P_0-resonance in Fig. 1 is decreased to $\approx 3.7\sigma$.

7. The average of five "resonance" spectra

We also computed $F'(\nu)$ separately for each of the five CBS's catalogues. Those functions were averaged, and the resulting $F_1'(\nu)$-spectrum – analogue to the former spectrum $F_1(\nu)$ – is plotted in Fig. 7. The numbers of objects in the 5 catalogues are very different, but the averaging procedure is justified because the $F'(\nu)$-functions are normalized.) The strongest peak corresponds to $P = 160.0 \pm 0.5$ min, with a formal $\mathscr{P} of \approx 4.6\sigma$; accounting for the effects of "quasi-persistency" and overlap of catalogues, the empirical C.L. is estimated to be $\approx 3.8\sigma$.

The P_0-effect cannot be explained in this case also by the presence of some peculiarity (e.g., a sharp excess, deep gap or distinct boundary) in the distribution of binary periods. One might imagine that the 160-min peak (Figs. 1 and 7) is a mere artifact of the upper limit of 5.5 d for periods that we applied for the sake of calculation. This explanation however does not hold, as was shown by many computations with various upper boundaries. Namely, when we changed the long-period boundary from 3 to 10 d, the amplitude of the primary peak – at the frequency $\approx$ 104.2 μHz – always emerged as significant, its formal statistical significance varying between $\approx 3.8\sigma$ and $\approx 4.4\sigma$.

8. Conclusion

About a decade ago Kotov & Koutchmy (1985) suggested that the 160-min period might be connected with disturbances in the gravitational field. At those times, the development of this hypothesis has led to stormy discussions on possible monochromatic 160-min GW induced by a distant, massive and very energetic source, e.g., by the binary γ- and X-ray system Geminga (Delache 1983; Arvonny 1983; Walgate 1983), which was supposed to stimulate solar oscillations with the 160-min period. However, it was almost immediately shown (Anderson et al. 1984; Fabian & Gough 1984; Bonazzola et al. 1984; Kuhn & Boughn 1984; Caroll et al. 1984) that if the general concept of GR is correct, this oscillation in the Sun could not have been driven to the observable amplitude by any binary source of stellar mass.

Irrespective of other explanations of the P_0-resonance observed in period distribution of close binaries, we consider it interesting to speculate that it might be of interest for the study and detection of GR (or QGR) in the Universe.

Since *(a)* the absolute majority of binaries under consideration have periods $P > 2P_0$, and *(b)* the two possible resonant effects, *A* and *B*, emerge as $F_0(\nu)$-peaks of opposite sign (positive and negative, respectively), the action of a hypothetical GW (QGW), can be formulated also this way: *A*-resonance – an excess of binaries at periods $P \approx (2Z + 1)\ P_0$(odd commensurability), and *B*-resonance – a lack of binaries at periods $P \approx (2Z)P_0$(even non-commensurability).

One of possibilities for the remarkable emergence of the 160-min peak in the period distribution of CBS's (Figs. 1 and 7), might be, e.g., a (hypothetical) mechanism of resonant excitation of this P_0-oscillation (of the gravitational field) by CBS's themselves. The latter, being numerous, might induce enhanced GW's (QGW's) at frequencies $\approx \nu_0/(2Z + 1)$ which, in turn, produce a substantial *excess* of systems with those frequencies, and also *a lack* of systems with frequencies which are even-commensurate with $\nu_0 \approx 104$ μHz, i.e. with $\nu \approx\ \nu_0/(2Z)$.

The phenomenon might relate also to some peculiar property of gravitation and time, and perhaps to cosmology. In conclusion, we would like also to refer to the recent discovery (Kotov et al. 1994) of the same P_0-periodicity in luminosity variations of the most massive single objects of the Universe – the active galactic nuclei. The existence of a P_0-oscillation (or, equally, of the P_0-periodicity) in the total sample of galactic CBS's, and also plausibly in AGN's, could yield a crucial insight into the true intrinsic nature of those objects.

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