Why are gravitational waves detections so close to New/Full Moon?

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Abstract. Of the 11 gravitational waves detections up to date, seven occurred within 43 hours of New/Full Moon or perihelion and four within a two-week period between the 2017/8/7 and 2017/8/21 eclipses. Why do the gravitational waves coming from millions of light years away arrive to Earth so close to these lunar events? The question is investigated in this paper.

Key words: gravitational waves, earthquakes, lunar motion.

The 11 known up to date detection of gravitational waves show an uncanny affinity to New/Full Moon similar to that exhibited by powerful earthquakes. The number of the gravitational waves detections is just too small to apply proper statistics leading to decisive conclusions, but it certainly provides food for thought. In the presentation we first discuss the correlation of powerful earthquakes to the lunar motion and then show that the gravitational waves detections exhibit similar correlation.

Introductory discussion of some aspects of seismicity. Let us recall that lunar perigees recur every ≈ 27.55 days, while the New/Full Moons recur every ≈ 29.53 days; thus the time between a perigee and the closest New/Full Moon changes each month by ≈ 2 days. Since $29.53 \times 14 \approx 413.4$ days and $27.55 \times 15 \approx 413.3$ days, the spread between perigee and the nearest New/Full Moon is almost the same after ≈ 413 days. A "full lunar cycle" is thus defined to be an ≈ 413 -day period that starts and ends with the same lunar phase and contains 14 New/Full Moons and 15 perigees. The closest and 2nd closest perigees of a full lunar cycle typically occur within 11 hours of a New/Full Moon. other perigees may be separated from the nearest New/Full Moon by days. On 2011/3/19, 2012/5/6, 2013/6/23, 2014/8/10, and 2015/9/28, Full Moon and perigee came within, correspondingly, 59, 2, 23, 27, and 65 minutes of each other creating an extremely rare case of five-year synchronization of Full Moon with perigees. The period was marked by elevated earthquake activity: 1) 2010 – 2012 had three $M \geqslant 8.6$ earthquakes averaging one earthquake per year, for comparison 1900 – 2009 had ten $M \geqslant 8.6$ earthquakes averaging ≈ 0.1 earthquakes per year; 2) 2010 – 2014 had five $M \geqslant 8.2$ earthquakes averaging 1 earthquake per year, for comparison

full lunar cycles	strongest earthquake of the full lunar cycle	d a y s	the closest perigee of the full lunar cycle and adjacent Full Moon	h o u rs	New/Full Moon within 88 hours of the earthquake	d a y s	other events
2009/7/5 - 2010/8/22	**2010/2/27** 6:34 M=8.8	28	2010/1/30 9:04 closest perigee 6:19 Full Moon, 2010/1/29 lunar node	34 45	**2010/2/28** 16:39 Full Moon, **2010/2/25** 9:11 lunar mode		
2010/8/22 - 2011/10/10	**2011/3/11** 5:46 M=9.1, M=7.9 aftershock	8	2011/3/19 19:10 closest perigee 18:11 Full Moon			2 1	**2011/3/9** X1.5 solar flare, **2011/3/10** CME reached Earth at 6:30
2nd strongest	**2010/10/25** 4:42 M=7.8	47	2010/9/8 4:02 2nd closest perigee 10:30 New Moon	2.2	**2010/10/23** 1:38 Full Moon		
2011/10/10 - 2012/11/26	2012/4/11 8:39 M=8.6, M=8.2 aftershock	26	2012/5/6 3:34 closest perigee 3:36 Full Moon, perigee and Full Moon separated by 2 minutes, 2012/5/7 lunar node			27	2012/3/7 X5.4 solar flare almost coincided with 2012/3/8 9:42 Full Moon
2nd strongest	2012/10/28 3:04 M=7.8	45	2012/12/12 23:15 2nd closest perigee 2012/12/13 10 32 New Moon	1.7	**2012/10/29** 19:51 Full Moon		
2012/11/26 - 2014/1/14	**2013/5/24** 5:45 M=8.3	31	2013/6/23 11:11 closest perigee 11:34 Full Moon	24 5	**2013/5/25** 4:27 Full Moon, **2013/5/24** 0:40 lunar node		
2014/1/14 - 2015/3/1	**2014/4/1** 23:47 M=8.2			29 22	**2014/3/30** 18:48 New Moon, **2014/4/1** 2:30 lunar node	3	**2014/3/29** X1 solar flare
2015/3/1 - 2016/4/20	**2015/9/16** 22:55 M=8.3	13	2015/9/28 1:47 closest perigee 2:52 Full Moon, 2015/9/27 lunar node	88 66	**2015/9/13** 6:43 New Moon, **2015/9/14** 4:38 lunar node		
2016/4/20 - 2017/6/8	**2016/12/17** 10:51 M=7.9, 2017/1/22 M=7.9 aftershock	34	2016/11/14 11:24 closest perigee 13:54 Full Moon, the closest perigee of 1949 – 2033	83	**2016/12/14** 0:07 Full Moon	19	2017/1/4 perihelion

Table 1: Correlation of the strongest earthquakes of full lunar cycles and lunar/solar events in 2009/6/8 – 2017/5/11, Earthquakes (2019), Walker (1997), Espenak (2019), Flares (2019). The 3rd, 5th and 7th columns show the number of days/hours between the strongest earthquake of the full lunar cycle and the event in the, correspondingly, 4th, 6th and 8th column. The closest perigee of each full lunar cycle is less than 3 hours away from Full Moon. The date of 2009/7/5 as the beginning of the first full lunar cycle was chosen rather arbitrarily and may be moved to an earlier or later date; once the first date of the first cycle is selected, the beginning and end of all other cycles are determined. Changing the first days of the first full lunar cycle will not change the earthquakes in this Table but may change the strongest and 2nd strongest earthquakes in Table 2.

full lunar cycles	strongest earthquake(s) of the full lunar cycle	d a y s	closest or 2nd closest perigee of the full lunar cycle	h o u rs	syzygy within 3 days of the earthquake	d a y s	other events
two most powerful earth-	**2007/9/12** 11:10 M=8.4	44	2007/10/26 11:52 closest perigee	25	**2007/9/11** 12:45 New Moon,		
			4:53 Full Moon		**2007/9/10** 14:49 lunar node		
quakes of 2007/3/31 - 2008/5/18	**2007/4/1** 20:40 M=8.1	17	2007/4/17 5:56 2nd closest perigee	22	**2007/4/2** 17:16 Full Moon		
			11:38 New Moon		**2007/3/31** 11:41 lunar node		
two most powerful earth-	**2009/1/3** 19:44 M=7.7	23	2008/12/12 21:38 closest perigee			1	**2009/1/4** 15:30 perihelion
			16:39 Full Moon				
quakes of 2008/5/18 - 2009/7/5	**2008/7/5** 2:12 M=7.7	33	2008/6/3 13:09 2nd closest perigee	48	**2008/7/3** 2:20 New Moon,	1	2008/7/4 aphelion
			19:24 New Moon	1	**2009/7/5** 1:39 lunar node		
2009/7/5 – 2017/6/8 period of Table 1							
two most powerful earth-	**2017/9/8** 4:49 M=8.2			46	**2017/9/6** 7:05 Full Moon, 2017/9/4	2	**2017/9/7** X9.3 solar flare
					18:41 lunar node		
quakes of 2017/6/8 - 2018/7/25	2018/1/23 9:32 M=7.9	23	2018/1/1 21:56 closest perigee				2018/1/3 perihelion
			2018/1/2 2:56 Full Moon				
two most powerful earthquakes of 2018/7/25 - 2019/9/12	**2018/8/19** 0:20 M=8.2	37	2018/7/13 8:30 2nd closest perigee			2	**2019/8/20** powerful CME
			2:50 New Moon				
	2019/5/26 7:41 M=8.0		2018/7/14 lunar node				

Table 2: Correlation of earthquakes of the two full lunar cycles before and after the period of Table 1 with lunar/solar events, Earthquakes (2019), Walker (1997), Espenak (2019), Flares (2019). The 3rd, 5th and 7th columns show the number of days/hours between the strongest earthquake of the full lunar cycle and the event in the, correspondingly, 4th, 6th and 8th column. The closest perigee of each full lunar cycle is more than 3 hours away from Full Moon.

1900 – 2009 had thirty nine $M \geqslant 8.2$ earthquakes averaging ≈ 0.36 earthquakes per year; 3) 2010 – 2015 had thirty five $M \geqslant 7.5$ earthquakes averaging 5.83 earthquakes per year, for comparison 1960 – 2009 had two hundred four $M \geqslant 7.5$ earthquakes averaging ≈ 4.08 earthquakes per year.

Even more remarkable is the correlation between earthquakes and lunar/solar events. Table 1 shows 7 full lunar cycles. In 6 out of 7 full lunar cycles the strongest earthquake struck within 34 days of the closest perigee. Since 2009/7/5 – 20017/6/8 comprised 2885 days and contained 7 closest perigees, the number of strongest earthquakes within 34 days of the closest perigees is expected to be $\approx \frac{7 \times 68}{2885} \times 7 \approx 1.2$ not 6. The 2014/4/1 earthquake was the only one more than 34 days away from the closest perigee; but it struck right after the 2014/3/30 New Moon and 2014/3/29 X1 solar flare. Also in 5 out of 7 full lunar cycles the strongest earthquake struck

Date, time, magnitude	likely relevant celestial events	time between
2005/3/28 16:10 M=8.6	**2005/3/25** 21:01 Full Moon,	67 hours
	2005/3/27 5:15 lunar node	35 hours
	2005/01/17 X3.8 solar flare	
2004/12/26 0:59 M=9.1	**2004/12/26** 21:31 Full Moon,	21 hours
	2005/1/2 perihelion,	7 days
	2005/1/10 New Moon-closest perigee	15 days
	2004/5/15 - 2006/1/20 numerous X1 - X7.1 solar flares	
2001/6/23 20:33 M=8.4	**2001/6/21** 11:59 New Moon,	59 hours
	2001/6/21 22:11 lunar node	
	2001/4/2 - 2001/4/30 numerous X1.1 - X20 solar flares	
1965/2/4 5:01 M=8.7	1964/12/19 Full Moon-closest perigee,	47 days
	1964/12/18 lunar node	
	1965/2/1 16:37 New Moon	60 hours
1964/3/28 3:36 M=9.2	**1964/3/28** 2:49 Full Moon	1 hour
1963/10/13 5:18 M=8.5	1963/11/2 Full Moon-closest perigee	20 days
1960/5/22 19:11 M=9.5	**1960/5/25** 12:27 New Moon,	68 hours
1957/3/9 M=8.6	1957/2/14 Full Moon-closest perigee	23 days
1952/11/4 16:58 M=9.0	**1952/11/1** 23:09 Full Moon	64 hours
1950/8/15 14:10 M=8.6	**1950/8/13** 16:47 New Moon	46 hours
	1950/8/16 12:16 lunar node	20 hours
1946/4/1 12:29 M=8.6	**1946/4/2** 4:39 New Moon	16 hours
1938/2/1 19:04 M=8.5	**1938/1/31** 13:35 New Moon	30 hours

Table 3: Correlation of M $\geqslant$ 8.4 earthquakes in 1935 – 2005 with lunar/solar events, Earthquakes (2019), Walker (1997), Espenak (2019), Flares (2019). "Closest perigee" means that all perigees within 210 days are farther away. The table starts at 1935 as it was the year the Richer scale was introduced, the table covers M $\geqslant$ 8.4 earthquakes as NOAA and USGS catalogs of Earthquakes (2019) unequivocally agree only for M $\geqslant$ 8.4 earthquakes.

within 88 hours ($\approx$ 3.7 days) of New/Full Moon. The 2011/3/11 earthquake was one of the two earthquakes more than 88 hours away from a syzygy; but it struck right after the 2011/3/9 X1.5 solar flare and merely 8 days after the 2011/3/19 closest perigee. In both full lunar cycles when the strongest earthquakes was more than 88 hours away from a syzygy, the 2nd most powerful earthquake struck within 2.2 hours of Full Moon and within 1.5 months of the 2nd closest perigee.

Table 2 shows the strongest and 2nd strongest earthquakes of the two full lunar cycles before and after the 2009/7/5 – 20017/6/8 period of Table 1. Although the influence of the lunar motion and solar flares on earthquakes is still observed, it is not as sharp as in Table 1, it is "smudged" between the strongest and 2nd strongest earthquakes. Tables 1, 2, and Table 3 showing all M $\geqslant$ 8.4 earthquakes in 1935/1/1 – 2007/9/11, reveal that all M $\geqslant$ 8.4 earthquakes in 1935 – 2019 struck either within 47 days of the closest perigee or within 3 days of New/Full Moon. The number of days in a full lunar cycle within 47 days of the closest perigee or within 3 days of New/Full Moon

Figure 1: The boundaries of the Arctic are almost the same as the boundary of the antipode of the Antarctica continental shelf.

Figure 2: The western boundary of North America is almost the same as the antipode of the eastern boundary of Africa.

is $\approx 47 \times 2 + 11 \times 3 \times 2 = 160$, hence a random event is expected to occur $\approx \frac{160}{413} \approx 39\%$ within 47 days of the closest perigee or within 3 days of New/Full Moon. Thus if $M \geqslant 8.4$ earthquakes in 1935 – 2019 struck completely randomly, only $\approx 39\%$ of them are expected to be within 47 days of the closest perigee or within 3 days of New/Full Moon, not all of them. Of course, syzygies and closest perigees cannot affect only $M \geqslant 8.4$ earthquakes, they must also affect earthquakes of lower magnitudes only to a lesser degree and less explicitly. We are compelled to conclude that the correlation between earthquakes and syzygies is due to tidal forces as syzygies augment tidal forces, proximity of syzygies to perigees or lunar nodes increases tidal forces even more. The 2011/3/11, 2014/4/1, 2017/9/8, and 2018/8/18 earthquakes struck within two days of powerful solar flares or CME, suggesting that the latter also contribute to powerful earthquakes. Since the only part of the Earth affected by both the tidal forces and the magnetic forces produced by solar flares/CMEs is the liquid core, we may hypothesize that powerful earthquakes have their power amplified by movements inside the liquid core; the movements themselves are caused/augmented by proximity to the closest/2nd closest perigee of a lunar cycle, syzygy, or a solar flare/CME. The earthquakes in Table 1 specifically had their power amplified by 1) 34-day proximity to the closest perigee of the full lunar cycle practically coinciding with Full Moon; 2) 3-day proximity to a syzygy; 3) proximity of the syzygy in 1) or 2) to a lunar node; 4) unusually short time between perigee and Full Moon on 2012/5/6; 5) unusual closeness of the Moon to Earth on 2016/11/14; 6) proximity to perihelion on 2017/1/4; 7) 3-day proximity to an X-level solar flare.

The currently accepted theories do not presume the dependence of earthquakes on any movements in the depths of the Earth. It is only a hypothesis, supported partly by Figures 1, 2. Figure 1 illustrates that the boundaries of the Arctic are almost identical to the boundaries of the antipode of Antarctica, Figure 2 illustrates that the western boundary of North America is almost

gravitational waves detections (confident)	days	closest or 2nd closest perigee of the full lunar cycle, or perihelion >1 day away	hours	syzygy within 2 days of the detection, or perihelion <1 day away	hours	relevant lunar nodes	days	most powerful earthquakes of 2015/9/1 – 2016/2/1 & 2016/12/1 – 2017/9/1
First observation run 2015/9/12 – 2016/1/19								
2015/9/14 9:51	15	2015/9/28 closest perigee - Full Moon,	27	**2015/9/13** 6:43 New Moon	5	**2015/9/14** 4:38 lunar node	1.5	**2015/9/16** 22:55 M=8.3 22 km Chile
2015/10/12 9:55	15	2015/9/27 lunar node	14	**2015/10/13** 0:07 New Moon	23	**2015/10/11** 10:54 lunar node	14	2015/10/26 M=7.5 231 km Afghanistan
								2015/10/27 Full Moon, 2015/12/25 aftershock
								8 hours before next detection
2015/12/26 3:39	8	2016/1/2 perihelion	17	**2015/12/25** 11:12 Full Moon			32	2015/11/24 two M=7.6 606 - 621 km Brazil, Peru 2015/11/25 Full Moon
Second observation run 2016/11/30 – 2017/8/25								
2017/1/4 10:12	52	2016/11/14 closest perigee - Full Moon, the closest perigee of 1949 – 2033	4	**2017/1/4** 14:18 perihelion				2016/12/17 10:51, 2017/1/22 04:30 M=7.9 38 - 135 km Papua New Guinea
							18, 19	
2017/6/8 2:01	14	2017/5/26 2nd closest perigee - New Moon	38	**2017/6/9** 13:31 Full Moon			40	2017/7/17 23:34 M=7.7 10 km Kamchatka
2017/6/8 is the last date in Table 1								
2017/7/29 18:56	On 2017/7/28 Jupiter, Moon and Earth were almost aligned.						12	
On 2017/8/1 Advanced Virgo joined Advanced LIGO								
2017/8/9 8:28			38	**2017/8/7** 18:13 Full Moon	22	**2017/8/8** 10:56 lunar node		
2017/8/14 10:31								2017/9/8 0:20 M=8.2 47 km Mexico preceded by 2017/9/6 Full Moon, 2017/9/7 X9.3 solar flare
2017/8/17 12:41 burst of EM radiation						2017/8/21 10:34 lunar node, solar eclipse all over USA		
2017/8/18 2:25			88	**2017/8/21** 18:32 New Moon				
2017/8/23 13:14			43		51			

Table 4: Gravitational waves detections, Catalog (2019), Earthquakes (2019), Walker (1997), Espenak (2019). The 2nd, 4th, 6th and 8th columns show the number of days or hours between a gravitational wave detection and the event in the, correspondingly, 3rd, 5th, 7th and 9th column; the number of day/hours is rounded up to the nearest integer or tenth.

identical to the antipode of the eastern boundary of Africa; neither one of these can be explained by continental drift as a continent cannot drift into its antipodal position. As a matter of fact, almost all boundaries of continental shelves are similar to their almost-antipodal counterparts. Such similarity cannot be explained by any currently popular theory; however, it can be explained by movements inside the Earth's interior.

Patterns in gravitational waves detections. The confirmed detections of gravitational waves in 2015/9/14 – 2017/8/23 are shown in Table 4. The first five occurred in the 2009/7/5 – 2017/6/8 period of Table 1 and followed a pattern similar to that of the earthquakes in Table 1: 1) all five detections are within 2 days of a syzygy or a perihelion; 2) four of the five detections are within 14 days of a perihelion or the closest/2nd closest perigee of a full lunar cycle with the perigee almost coinciding with Full Moon. Since an average year contains $\approx \frac{365.25}{29.53 \times 0.5} \approx 24.74$ syzygies and one perihelion, the probability of a random event falling within 1.5 days of a syzygy or a perihelion is $\approx \frac{(24.74+1) \times 3}{365.25} \approx 0.2$; hence the number of gravitational waves detections randomly falling within 1.5 days of a syzygy or a perihelion should be $\approx 0.2 \times 7 \approx 1.5$. Yet all five gravitational waves detections came within 1.5 days of a syzygy or perihelion. The 2017/8/14 – 2017/8/18 detections of gravitational waves do not adhere to New/Full Moon; instead, they are sandwiched between the 2017/8/7-8 lunar eclipse and 2017/8/21 solar eclipse. The 2017/7/29 detection was within a day of the 2017/7/28 Jupiter - Moon - Earth alignment when the Moon's gravity was boosted by Jupiter's.

The three confirmed detections of the first observation run 2015/9/12 – 2016/1/19 can be associated with the four most powerful earthquakes of 2015/9/1 – 2016/2/1 as shown in Table 4. The confirmed detections of the second observation run 2016/11/30 – 2017/8/25, may also be associated with the most powerful earthquakes of 2016/12/1 – 2017/9/1 but not as obviously. Figure 3 from LIGO's web site and its caption show the relationship between the "amplitudes" of the gravitational waves in 2015/9/12 – 2017/6/8 and the magnitudes of the associated earthquake(s). The probability that the "amplitudes" of the five detections of the five gravitational waves in 2015/9/12 – 2017/6/8 randomly correlate with the magnitudes is $\frac{1}{5!} = \frac{1}{120} < 1\%$. The post-2017/6/8 detections do not seem to follow the same pattern.

Table 5shows that all confirmed detections and marginal triggers of the second observation run may be divided into four groups separated from each other by over-one-month long breaks.

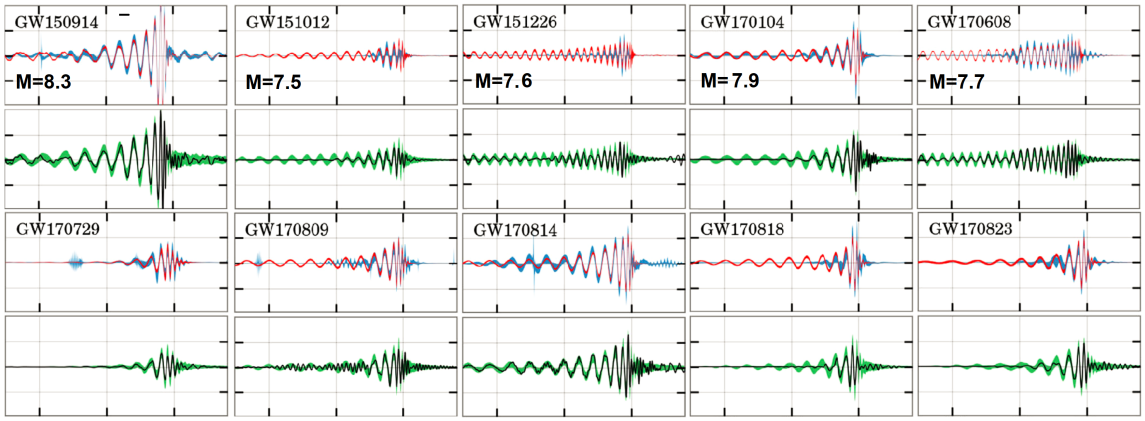

Figure 3: Time-frequency maps and reconstructed signal waveforms for the ten BBH events from LIGO's https://www.ligo.org/news.php and https://arxiv.org/ftp/arxiv/papers/1811/1811.12907.pdf, see details there, and the magnitudes of the associated earthquakes from Table 4. Whereas the relative "amplitudes" of the signals of GW150914 – GW170609 are more or less consistent throughout the sources, the relative "amplitudes" of the later signals vary between different pictures posted by LIGO making it difficult to determine which one is larger and which one is smaller.

Within each group the detections/triggers correspond to the strongest earthquakes of the corresponding time period with only three exceptions: 1) confirmed detection of 2017/7/29 does not have an earthquake counterpart, it is notably absent from the original list of gravitational waves detections at https://www.gw-openscience.org/events/; 2) the Christmas eve 2016/12/25 M = 7.6 earthquake does not have a gravitational wave counterpart; 3) the 2017/7/11, 2017/7/13, 2017/7/17, 2017/7/18 earthquakes do not have gravitational waves counterparts. Of the 19 confirmed detections and marginal triggers of Table 5, 15 came within hours of most powerful earthquakes of the corresponding periods; two (2016/12/2 and 2017/6/30) came within hours of powerful but not the most powerful earthquakes; and two (2017/6/8 and 2017/7/29) did not have any M $\geqslant$ 6 nearby. Of course, M $\geqslant$ 6.3 earthquakes are not that rare and it is not hard to find a M $\geqslant$ 6.3 earthquake within a few days of each detection/trigger; what is special about Table 5 is that the detections/triggers come within hours not days of the strongest earthquakes of the corresponding periods and the very close proximity of the detections/triggers to these earthquakes.

The 2017/8/17 burst of electromagnetic radiation is presented as a proof that the 2017/8/17 detection was of a gravitational wave from far away. Let us recall that the most powerful known burst of $\gamma-$ rays 2004/12/27 came a day after the devastating 2004/12/26 M=9.1 earthquake. Was it a pure coincidence or the bursts of electromagnetic radiation are somehow connected to the

confirmed detections and marginal triggers		hours	nearby earthquakes with date, time, magnitude depth, location	comments	comments
2016/12/2 3:54	m	>65	2016/12/8 17:39 M=7.8 40 km Solomon Islands	three of the four strongest quakes of 2016/11/14 – 2017 /1/9, the fourth one is 2016/12/25 M=7.6	2016/12/2 trigger was 6 hours before 2016/12/1 22:40 M=6.2 earthquake, preceded by 2016/11/29 New Moon
2016/12/17 7:16	m	4	**2016/12/17** 10:51 M=7.9 94 km Papua New Guinea		
2017/1/4 10:12	C	13	**2017/1/3** 21:52 M=6.9 12 km Fiji		
over-one-month break between detections/triggers					
2017/2/8 10:38	m	13 48	**2017/2/7** 22:04 M=6.3 29 km Pakistan 2017/2/10 14:04 M=6.5 15 km Philippines	the four strongest earthquakes of 2017/1/23 – 2017/2/23	
2017/2/19 14:04	m	26 48	**2017/2/18** 12:10 M=6.4 222 km Argentina, 2017/2/21 14:09 M=6.5 596 km Bolivia		The distance between the epicenters $23.861^{\circ}S, 66.659^{\circ}W$, $19.281^{\circ}S, 63.905^{\circ}W$ of the 2017/2/18 and 2017/2/21 quakes is ≈585 km. Thus 2017/2/18 may be viewed as a foreshock of 2017/2/21
over-one-month break between detections/triggers					
2017/4/5 11:05	m	42	2017/4/3 17:40 M=6.5 29 km Botswana	the three strongest earthquakes of 2017/3/30 – 2017/4/27	
2017/4/12 15:57	m	65	2017/4/15 8:20 M=6.3 155 km Chile		
2017/4/23 12:11	m	35	2017/4/24 21:38 M=6.9 29 km Chile		
over-one-month break between detections/triggers					There was a M=6.0 2017/6/30 22:30 earthquake in Ecuador 13 km deep, 6 hours after the 2017/6/30 trigger. 2017/6/9 New Moon may have contributed to 2017/6/8 detection There were no earthquakes of interest near the 2017/7/29 detection.
2017/6/8 2:01	C	>65	2007/6/2 22:25 M=6.8 5 km Alaska	nine of the thirteen strongest earthquakes of 2017/5/30 – 2017/9/7; the other four are: 2017/7/11 M=6.6, 2017/7/13 M=6.4, 2017/7/17 M=7.7, 2017/7/18 M=6.4. Detections and triggers on 2016/12/2, 2017/4/12, 2017/6/8, 2017/8/23 were close to New/Full Moon	
2017/6/16 19:47	m	61	2017/6/14 7:29 M=6.9 93 km Guatemala		
2017/6/30 16:17	m	>65	2017/6/22 12:31 M=6.8 38 km Guatemala		
2017/7/5 8:45	m	24	**2017/7/6** 8:04 M=6.5 9 km Philippines		
2017/7/20 22:45	m	0.3	**2017/7/20** 22:31 M=6.6 7 km Greece		
2017/7/29 18:56	C				
On 2017/8/1 Advanced Virgo joined Advanced LIGO					
2017/8/9 8:28	C	19	**2017/8/8** 13:20 M=6.5 9 km China		
2017/8/14 10:31	C	32	2017/8/13 3:08 M=6.4 31 km Indonesia		
2017/8/17 12:41	C	15	**2017/8/18** 2:59 M=6.6 35 km Ascension Island 2017/8/19 2:01 M=6.4 544 km Fiji		2017/8/17 detection was accompanied by a burst of electromagnetic radiation
2017/8/18 2:25	C	0.6 24			
2017/8/23 13:14	C	>65			

Table 5: Gravitational waves detections and marginal triggers of the second observation run and nearby earthquakes, Catalog (2019), Earthquakes (2019). In the second columns "C" denotes a confident detection, "m" denotes a marginal trigger.

earthquakes?

We hypothesised earlier that the movements within the liquid core caused by syzygies, perigees, lunar nodes, solar flares/CMEs, etc. amplify the earthquakes' power. Such movements would produce seismic activity and minute changes in the gravitational field. The LIGO team claims they have eliminated seismic signal from that of the gravitational waves. But there are presently no mechanical instrumentation capable of shielding from the minute changes of the gravitational field, nor are there any theories capable of calculating the effects of these minute changes. Can LIGO team explain the almost antipodal symmetry of Figures 1, 2 or explain what caused it? And if they cannot, how can they be sure the forces responsible for the antipodal symmetry did not produce their signals?

Could the signals interpreted as gravitational waves be in fact caused by other phenomena like movements in the liquid core or minute changes in the gravitational field? Is the similarity in the pattern of gravitational wave detections and the pattern of earthquakes merely coincidental or an indication that the detections of gravitational waves were in fact detections of something else? Our doubts are echoed by Creswell, et al (2017), whose authors also note a strange similarity in the noise surrounding the 2015/9/14 gravitational wave signal. Could the noise be of seismic nature rather than true white noise?

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