A Planetary Alignment Solar System Simulator for Earthquake Research

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In this work we develop a user friendly online application which models our solar system using JavaScript and includes many useful features which allow us to do basic research on identifying dates of planetary alignments. Using this application we demonstrate that nearly all of the significant earthquakes (7+ Richter) between 2004 and 2011 have occurred on dates of planetary alignments within + - 1 day.

I. INTRODUCTION

The problem of developing online software for our solar system is well known, and there exist numerous stand alone sophisticated software mainly of 'planetarium' style, with huge collection of stars comets galaxies and other planetary bodies. Online software however are few and are used mainly for educational purposes concentrating on our solar system. Even fewer are the programs that allow us to see, calculate or draw planetary alignments.

This paper discusses the solar system simulator we developed and we used especially for observing and studying planetary movement. The simulator is a PHP generated website, consisting of a set of necessary tools in order to grasp a basic insight of our solar system and most importantly it allows us to study planetary alignments. Planetary alignments have recently been studied [1], linking to earthquakes. We have studied the dates of all 7+ Richter earthquakes within the database of the European–Mediterranean Seismological Centre, (EMSC) [2], and using our application we have demonstrated that all 7+ Richter earthquakes in

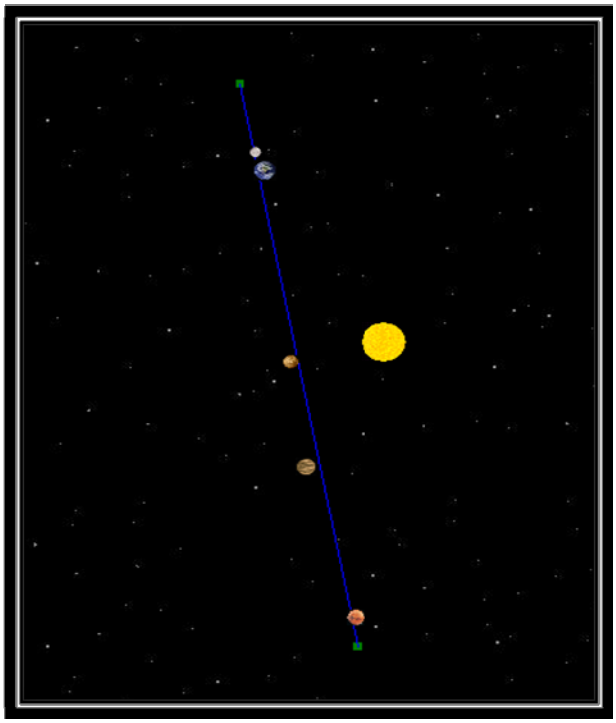

Figure 1: *A typical multiplanetary alignment*

The EMSC database coincide with at least one 3-planet alignment.

II. SYSTEM ARCHITECTURE

The system architecture is based on technologies that enabled us to create a very simple and user friendly website, Figure 2, for even an inexperienced user. The programming languages we used are the following:

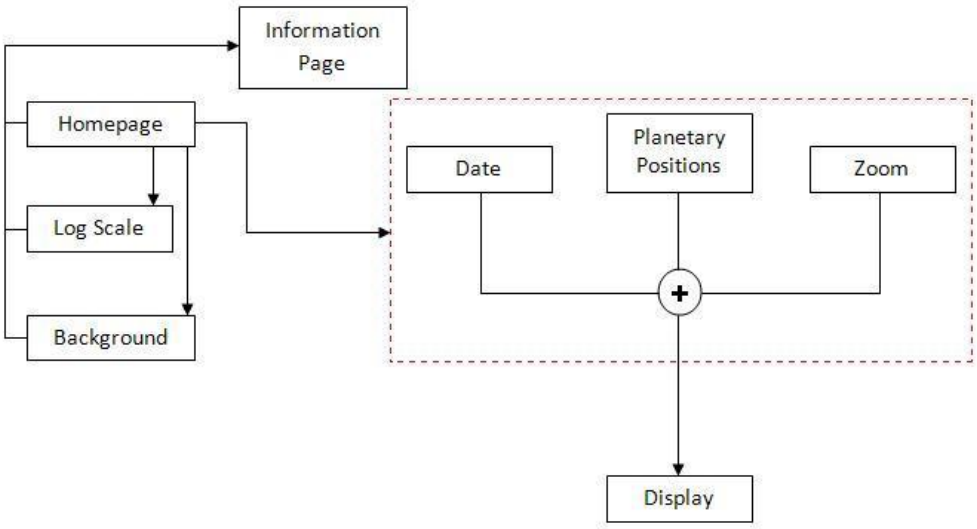

Figure 2*: System Architecture*

A) PHP:

PHP is a general-purpose scripting language originally designed for web development to produce dynamic web pages. For this purpose, PHP code is embedded into the HTML source document and interpreted by a web server with a PHP processor module, which generates the web page document. It also has evolved to include a command-line interface capability and can be used in standalone graphical applications. PHP can be deployed on most web servers and as a standalone interpreter, on almost every operating system and platform free of charge. PHP is installed on more than 20 million websites and 1 million web servers.

B) JavaScript:

JavaScript, also known as ECMAScript, is a prototype-based, object-oriented scripting language that is dynamic, weakly typed and has first-class functions. It is also considered a functional programming language like Scheme and OCaml because it has closures and supports higher-order functions. JavaScript is an implementation of the ECMAScript language standard and is primarily used in the form of client-side JavaScript, implemented as part of a web browser in order to provide enhanced user interfaces and dynamic websites. This enables programmatic access to computational objects within a host environment. JavaScript uses syntax influenced by that of C. JavaScript copies many names and naming conventions from Java, but the two languages are otherwise unrelated and have very different semantics. The key design principles within JavaScript are taken from the Self and Scheme programming languages.

With the use of those technologies we achieved on creating scripts that calculate planetary positions and define planetary elliptic movement with a minor inclination of one day. It's also important to mention that we used **Kepler's equations of planetary motion**.

The analysis of VSOP87 [3] and J2000 (from NASA's Database) [4] were used to define our obituary data which is described by:

- **a = Semi-major axis (AU)**
- **T = Orbital period**
- **e = Orbital eccentricity**
- **inc = Orbital inclination (deg)**
- **OM = Longitude of ascending node (deg)**
- **om = Argument of perihelion**

III. TOOLS

As mentioned above in order to succeed in creating a user friendly environment we constructed a set of tools for our application.
The tools and their functions are listed below:

 Zoom Out Button. This is necessary for zooming out to view the outer planets.

 Zoom In Button. This is used for zooming in to focus on specific configurations and for the inner planets.

 Background Button - Changes background for better visibility of the planets

 Today - Resets websites date to current date

 Step Forward Button - Proceeds one day

 Forward Button – Increases date continuously

 Stop Button

 Step Backward Button – Decreases by one day

 Backward Button – Decreases date continuously

 Log Button-Changes planetary orbit distances to logarithmic scale. For viewing all planets in a single screen.

 Information Page Button

 Clear Button - Clears the alignment lines

Date Box - User can insert any date for planetary display

Also we provide a feature which allows line drawing. This can be used for observing planetary alignments. The user simply can click anywhere on our website and a **green marker,** (Figure 3), is positioned. Then by clicking on any other point **a line is formed** between the two points, (Figure 4).

Figure 3. *Green marker* on the first selected point

Figure 4. *Line formed to align planets*

IV. USER INTERFACE

The following screenshots present our websites main page.

On **Figure 5** is the application screen with the function buttons and the date on top. Bellow are the planets of our solar system for the selected date. Comets can be displayed, On the right side you can notice comet Halley.

Figure 6. is the info page which contains clickable photos of all the planets (and comet Halley). When a planet is selected the user is being redirected to NASA's website which contains planetary sheets with description of the planets.

V. PLANETARY ALIGNMENT

Using the developed application we have counted and studied all the 7+ Richter earthquake data dates (109 from 2004).

For each date we have examined for planetary alignments involving either or both the earth and the sun. We have discovered 82 alignments of 3 or more planets from the 109 dates, i.e75%. We have 19 of the 7+R earthquakes where there is a corresponding earth moon and another planet alignment, i.e. 7.3%.

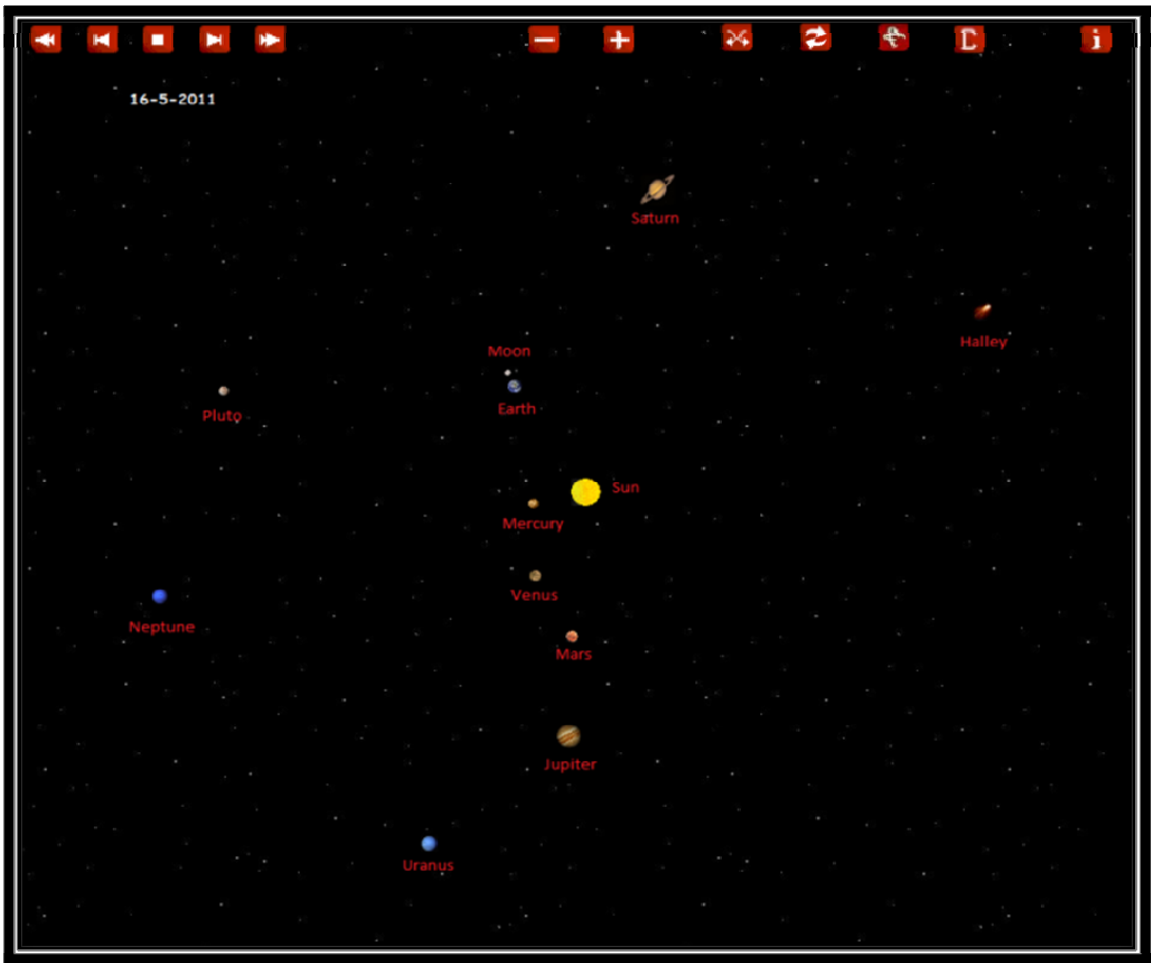

Figure 5. *The displayed planets in their position for the specific date, and the user keys at the top.*

Figure 6. *Information key give detail data about each planet of our solar system.*

DATE	ALIGNMENTS	MAGNITUDE	DEVIATION	REGION
04/07/2011	VENUS-MARS-JUPITER	7.1		NEAR EAST COAST OF HONSHU, JAPAN
03/11/2011	SATURN-VENUS-MARS	7.6		OFF EAST COAST OF HONSHU, JAPAN
03/11/2011	SATURN-VENUS-MARS	7.9		NEAR EAST COAST OF HONSHU, JAPAN
03/09/2011	SATURN-VENUS-MARS ; SARURN-EARTH-JUPITER	7.2		NEAR EAST COAST OF HONSHU, JAPAN
18/1/2011	JUPITER-SUN-SATURN	7.2		SOUTHWESTERN PAKISTAN
13/1/2011	JUPITER-SUN-SATURN	7		LOYALTY ISLANDS
01/02/2011	VENUS-MERCURY-MARS ; JUPITER-SUN-SATURN	7.1		BIO-BIO, CHILE
25/12/2010	//	7.3		VANUATU REGION
21/12/2010	MOON-EARTH-SUN ; JUPITER-SUN-SATURN	7.4		BONIN ISLANDS, JAPAN REGION
25/10/2010	EARTH-VENUS-MERCURY	7.7		KEP. MENTAWAI REGION, INDONESIA
29/9/2010	MARS-VENUS-EARTH	7.2	1	NEAR S COAST OF PAPUA, INDONESIA
09/03/2010	EARTH-MERCURY-SUN	7	1	SOUTH ISLAND OF NEW ZEALAND
08/12/2010	EARTH-MOON-VENUS-MARS ; SUN-MERCURY-VENUS	7.1	1	ECUADOR
08/10/2010	MARS-VENUS-EARTH ; EARTH-MOON-SUN	7.3		VANUATU
08/04/2010	JUPITER-EARTH-MARS	7		NEW BRITAIN REGION, P.N.G.
23/7/2010	MARS-MERCURY-SUN ; SATURN-VENUS-JUPITER	7.4		MORO GULF, MINDANAO, PHILIPPINES
23/7/2010	MARS-MERCURY-SUN ; SATURN-VENUS-JUPITER	7.4		MORO GULF, MINDANAO, PHILIPPINES
23/7/2010	MARS-MERCURY-SUN ; SATURN-VENUS-JUPITER	7.3		MORO GULF, MINDANAO, PHILIPPINES

18/7/2010	//	7.2		NEW BRITAIN REGION, P.N.G.
16/6/2010	MERCURY-SUN-MARS	7	-1	NEAR N COAST OF PAPUA, INDONESIA
06/12/2010	MERCURY-SUN-VENUS ; EARTH-MOON-SUN	7.5		NICOBAR ISLANDS, INDIA REGION
27/5/2010	MOON-EARTH-SUN	7.2	1	VANUATU
05/09/2010	MOON-EARTH-SATURN	7.2		NORTHERN SUMATRA, INDONESIA
04/06/2010	VENUS-MERCURY-EARTH ; JUPITER-SUN-MARS	7.7		NORTHERN SUMATRA, INDONESIA
04/04/2010	VENUS-MERCURY-EARTH	7.2	1	BAJA CALIFORNIA, MEXICO
03/11/2010	MOON-EARTH-MARS	7.2		LIBERTADOR O'HIGGINS, CHILE
26/2/2010	JUPITER-SUN-EARTH ; VENUS-SUN-SATURN	7.2		RYUKYU ISLANDS, JAPAN
01/12/2010	VENUS-SUN-EARTH	7.1		HAITI REGION
01/03/2010	VENUS-SUN-MERCURY-EARTH	7.1		SOLOMON ISLANDS
11/09/2009	MERCURY-SUN-EARTH	7.1	-1	FIJI
24/10/2009	//	7		BANDA SEA
10/07/2009	//	7.4		VANUATU
10/07/2009	//	7.8		SANTA CRUZ ISLANDS
10/07/2009	//	7.6		SANTA CRUZ ISLANDS
30/9/2009	MOON-EARTH-VENUS	7.6	1	SOUTHERN SUMATRA, INDONESIA
09/02/2009	EARTH-MOON-SUN	7.1	1	JAVA, INDONESIA
08/10/2009	MERCURY-SUN-VENUS-JUPITER ; SUN-EARTH-JUPITER	7.6	-1	ANDAMAN ISLANDS, INDIA REGION
15/7/2009	EARTH-SUN-MERCURY	7.8	-1	OFF W. COAST OF S. ISLAND, N.Z.
28/5/2009	//	7.1		OFFSHORE HONDURAS
19/3/2009	MARS-MERCURY-SUN ; JUPITER-MERCURY-SUN	7.9	-1	TONGA REGION
02/11/2009	VENUS-MARS-SUN ; JUPITER-MARS-MERCURY	7.1		KEPULAUAN TALAUD, INDONESIA
15/1/2009	MARS-SUN-MERCURY	7.4		EAST OF KURIL ISLANDS
01/03/2009	JUPITER-MERCURY-EARTH ; MARS-MERCURY-VENUS	7.3		NEAR N COAST OF PAPUA, INDONESIA
01/03/2009	JUPITER-MERCURY-EARTH ; MARS-MERCURY-VENUS	7.6		NEAR N COAST OF PAPUA, INDONESIA
24/11/2008	MERCURY-SUN-EARTH	7.3		SEA OF OKHOTSK
16/11/2008	MOON-EARTH-VENUS	7.4	1	MINAHASA, SULAWESI, INDONESIA
19/10/2008	JUPITER-VENUS-SUN	7	1	TONGA
29/9/2008	SUN-MOON-EARTH	7	1	KERMADEC ISLANDS, NEW ZEALAND
09/08/2008	EARTH-MERCURY-MARS	7		VANUATU
07/05/2008	SUN-MOON-EARTH	7.7	-1	SEA OF OKHOTSK
13/6/2008	EARTH-SUN-VENUS	7		EASTERN HONSHU, JAPAN
05/12/2008	SUN-MARS-SATURN	7.9		EASTERN SICHUAN, CHINA
04/12/2008	MARS-MERCURY-VENUS	7.1		MACQUARIE ISLAND REGION
04/09/2008	MARS-MERCURY-VENUS	7.3	1	LOYALTY ISLANDS
20/3/2008	MARS-SUN-VENUS	7.2		XINJIANG-XIZANG BORDER REGION
25/2/2008	EARTH-MERCURY-VENUS ; JUPITER-VENUS-SUN	7	1	KEP. MENTAWAI REGION, INDONESIA
20/2/2008	SUN-EARTH-MOON	7.3	1	SIMEULUE, INDONESIA
19/12/2007	MERCURY-SUN-EARTH ; MARS-SUN-MERCURY-JUPITER	7.2		ANDREANOF ISLANDS, ALEUTIAN IS.
12/09/2007	EARTH-MOON-SUN ; SUN-VENUS-SATURN	7.8		SOUTH OF FIJI ISLANDS
29/11/2007	JUPITER-MERCURY-VENUS	7.4		MARTINIQUE REGION, WINDWARD ISL.

14/11/2007	MOON-EARTH-MARS	7.7		ANTOFAGASTA, CHILE
31/10/2007	JUPITER-SUN-VENUS	7.1		PAGAN REG., N. MARIANA ISLANDS
30/9/2007	MARS-VENUS-MERCURY	7.4		AUCKLAND ISLANDS, N.Z. REGION
28/9/2007	MARS-VENUS-MERCURY	7.4		VOLCANO ISLANDS, JAPAN REGION
13/9/2007	EARTH-MOON-MERCURY	7.1		KEP. MENTAWAI REGION, INDONESIA
09/12/2007	//	7.8		KEP. MENTAWAI REGION, INDONESIA
09/02/2007	MARS-SUN-MERCURY	7.3		SANTA CRUZ ISLANDS
15/8/2007	EARTH-VENUS-SUN-MERCURY	7.9	1	NEAR COAST OF CENTRAL PERU
08/08/2007	EARTH-MOON-MARS	7.5		JAVA, INDONESIA
08/01/2007	MOON-EARTH-VENUS	7.2		VANUATU
25/3/2007	MOON-EARTH-JUPITER	7.2		VANUATU
21/1/2007	MERCURY-MARS-JUPITER	7.5		MOLUCCA SEA
26/12/2006	SUN-MARS-JUPITER	7.2		TAIWAN REGION
20/8/2006	EARTH-MOON-VENUS	7.1		SCOTIA SEA
17/7/2006	EARTH-MERCURY-SUN ; VENUS-SUN-JUPITER	7.7	1	SOUTH OF JAVA, INDONESIA
16/5/2006	VENUS-SUN-SATURN	7.5		KERMADEC ISLANDS REGION
05/03/2006	JUPITER-EARTH-SUN	7.8		TONGA
20/4/2006	URANUS-VENUS-EARTH ; SATURN-MARS-SUN	7.7		KORYAKIA, RUSSIA
22/2/2006	MOON-EARTH-MARS	7.1	-1	MOZAMBIQUE
27/1/2006	MERCURY-SUN-EARTH ; MARS-EARTH-JUPITER	7.6		BANDA SEA
01/02/2006	EARTH-MOON-VENUS	7.1	-1	FIJI REGION
01/02/2006	EARTH-MOON-VENUS	7.3	-1	EAST OF SOUTH SANDWICH ISLANDS
14/11/2005	EARTH-MOON-MARS	7.2	1	OFF EAST COAST OF HONSHU, JAPAN
10/08/2005	JUPITER-SUN-MARS	7.6		PAKISTAN
26/9/2005	VENUS-EARTH-MARS ; MERCURY-SUN-MARS	7.5	1	NORTHERN PERU
09/09/2005	MOON-EARTH-MARS	7.6		NEW IRELAND REGION, P.N.G.
16/8/2005	MARS-MERCURY-SUN	7.2		NEAR EAST COAST OF HONSHU, JAPAN
24/7/2005	URANUS-MARS-SUN	7.2		NICOBAR ISLANDS, INDIA REGION
15/6/2005	MARS-SUN-VENUS ; MOON-EARTH-MARS	7.1		OFF COAST OF NORTHERN CALIFORNIA
13/6/2005	MARS-SUN-MERCURY	7.8	-1	TARAPACA, CHILE
03/02/2005	EARTH-SUN-URANUS	7.1		BANDA SEA
02/05/2005	EARTH-MOON-MARS	7		CELEBES SEA
26/12/2004	MOON-EARTH-MERCURY-VENUS ; MARS-VENUS-SUN	7.3	-1	NICOBAR ISLANDS, INDIA REGION
23/12/2004	MARS-VENUS-SUN	7.8	1	NORTH OF MACQUARIE ISLAND
28/11/2004	SUN-EARTH-MOON	7		HOKKAIDO, JAPAN REGION
26/11/2004	MERCURY-SUN-JUPITER	7.1	-1	PAPUA, INDONESIA
22/11/2004	MERCURY-SUN-VENUS	7.1		OFF W. COAST OF S. ISLAND, N.Z.
15/11/2004	EARTH-MOON-MERCURY	7		NEAR WEST COAST OF COLOMBIA
11/11/2004	EARTH-MOON-VENUS	7.2	-1	BANDA SEA
11/09/2004	SATURN-SUN-MERCURY	7	1	SOLOMON ISLANDS

Table 1: Planetary alignments of specific 8+ R earthquakes.

DATE	ALIGNMENTS	MAGNITUDE	DEVIATION	REGION

03/11/2011	JUPITER-MERCURY-SATURN	9		NEAR EAST COAST OF HONSHU, JAPAN
27/2/2010	JUPITER-SUN-EARTH	8.8		OFFSHORE MAULE, CHILE
29/9/2009	EARTH-MOON-JUPITER	8.1		SAMOA ISLANDS REGION
09/12/2007	JUPITER-EARTH-VENUS	8.4		SOUTHERN SUMATRA, INDONESIA
04/01/2007	MERCURY-SUN-EARTH	8.1		SOLOMON ISLANDS
13/1/2007	JUPITER-MARS-MERCURY	8.2	1	EAST OF KURIL ISLANDS
15/11/2006	JUPITER-VENUS-EARTH	8.3		KURIL ISLANDS
28/3/2005	EARTH-MERCURY-SUN-VENUS	8.6	1	NORTHERN SUMATRA, INDONESIA
26/12/2004	MOON-EARTH-MERCURY-VENUS; MARS-VENUS-SUN	9.3	-1	OFF W COAST OF NORTHERN SUMATRA

Table 2: *Earthquake Magnitude >8R and the corresponding planetary alignments.*

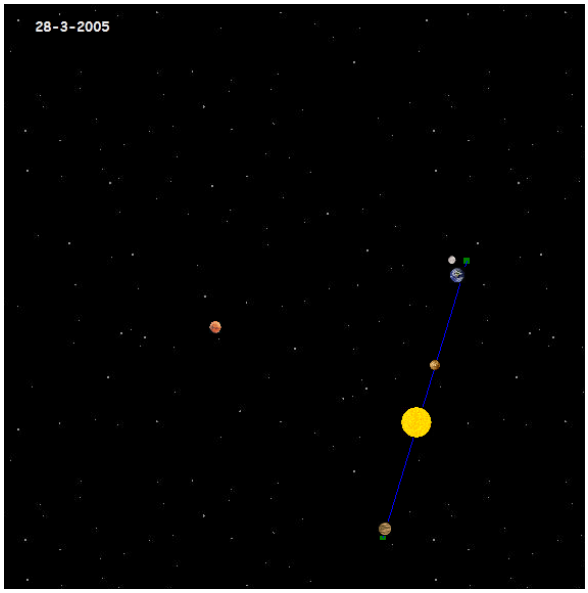

Figure 7*: Planetary alignment on 28/3/2005 (8.6R)*

EARTH-MERCURY-SUN-VENUS

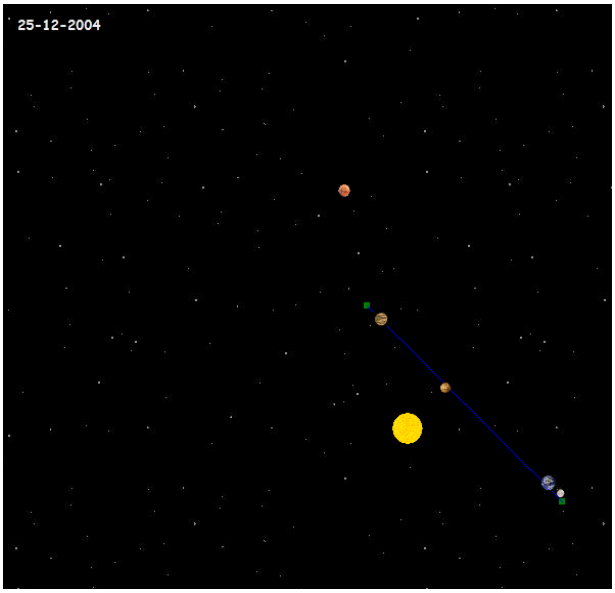

Figure 8. *Planetary alignment on 25/12/2004 (-1d) (9.3R)*

MOON-EARTH-MERCURY-VENUS; MARS-VENUS-SUN

Figure 7 shows the planetary alignment of the 28/3/2005 which resulted in an 8.5R tremor. We can see that the Earth Mercury and Venus were aligned.

In a similar manner Figure 8 shows the planetary alignment of the 25/12/2004 which resulted in a 9.3R tremor. Within a day the planets Earth Moon Mercury and Venus as well as Mars Venus and Sun were aligned.

VI. CONCLUSION

We have developed a solar system simulator suitable for earthquake research. The simulator is allows the position of the planets on their orbits for any selected date. The system allows for prediction of future planetary alignments as well as previous ones. We have carried out a research and showed that from 2004 only 7 of the 109 earthquakes of magnitude >7R were not accompanied by a planetary alignment.

REFERENCES

[1] 'Astronomical Alignments as the cause of ~M6+ seismicity' Cornell University Library arXiv:1104.2036v1[physics-gen-ph] Mensur Omerbashich

[2] European Mediterranean Seismological Centre, http://www.emsc.org

[3] "Planetary theories in rectangular and spherical variables. VSOP87 solutions" P. Bretagnon and G. Francou.Astron. Astropys. 202,309-315 (1988).

[4] http://www.jpl.nasa.gov/

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