

"Earthquakes in 1982"

A guided critique of a "shaky" idea.

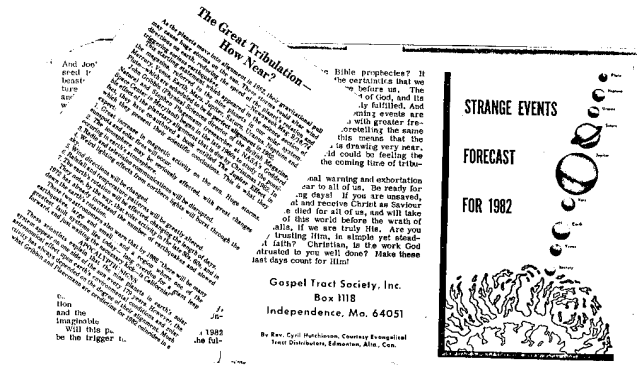
By Dr. Gary Mechler*

In 1974 two Ph.D. astronomers, no less, gave warning to the world that serious earthquakes activity would rack the world in 1982. Their trigger: the planets of the solar system. The title of their book was

The Jupiter Effect

In it they ominously concluded, *"And one region where one of the greatest fault systems today lies under a great strain, long overdue for a giant leap forward and just awaiting the necessary kick, is California. Most likely, it will be the Los Angeles portion of the fault to move this time. Possibly, it will be the San Francisco area which has a major quake. The prospect of both these sections of the fault moving at once hardly bears thinking about. In any case, a major earthquake will herald one of the greatest disasters of modern times."* Grab your attention? It did a lot of people's. Let's take a closer look.

Although astrologers paid little heed, much publicity was generated by some fundamentalist groups who viewed the alleged planetary alignment as fulfillment of biblical prophecy.



In this exercise I want to lead you to discover for yourself some of the damning objections scientists have raised in response to this theory. This is an exercise in learning how science works. A theory is proposed; a theory is tested. You are given here certain relevant basic data so that you can test this theory yourself.

First of all, let's take a close look at the Jupiter Effect in outline form. The authors assert a chain of triggering events starting with a line-up of planets and ending with cataclysmic earthquakes on, well, earth...

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The Theory

A. The planets gravitationally affecting the sun.

1. The authors claimed that in 1982 the planets would all be in line outwards from the sun. To quote from p. 101 of the first edition, hardbound, *"Between 1977 and 1982 the planets of the solar system will be moving into an unusual alignment in which every planet is in conjunction with every other planet; that is, all the planets will be aligned on the same side of the sun. Such an alignment occurs only once in 179 years...Over a few critical months, there will be both a superopposition with Mercury on one side of the Sun and every other planet on the other, and a superconjunction with all nine planets in line on the same side of the Sun."*
2. This alignment would allegedly stretch out the sun through the planet's combined gravitational tidal pull.
3. This tidal stretching would then exacerbate conditions on the sun's surface, making even greater an already expected sunspot maximum (with its attendant flares).

B. The sun's magnetic activity cycle (MAC) affecting the earth.

4. Sunspots and flares are manifestations of the solar MAC. Flares blast out into space electrically charged bits of atoms. These are called ions. These ions (forming the high energy component of the solar wind) may strike the earth. With an unusually high number of flares, the likelihood is increased that the earth will be showered by solar winds.
5. The authors then suggested that the increased solar wind would alter the earth's rate of rotation by either one or both of the following possible mechanisms:
 - a) interacting with the earth's magnetic field to induce a torque upon the earth, or
 - b) interacting with the earth's atmosphere to massively alter the circulation patterns, changing our weather and winds, and thereby friction between the atmosphere and the surface.
6. Finally, this change in rotation, however modest, would then create a stress on the earth. On the surface the stress would trigger the movement of the continental plates. The authors predicted that the fault lines along these plate boundaries would be the scene of many violent earthquakes.

As you see, this could sound rather frightening! After all, what can we do to stop the planets from lining up? The whole idea, in fact, hinges on this point--a planetary line-up. So let's take a look at this first link in the Jupiter Effect chain of triggering events.

I. ON THE PLANETARY "SUPERCONJUNCTION" (authors' term):

Several sources are available which give the heliocentric longitudes (directions from the sun) for the planets for any year. The U.S. Naval Observatory says the closest configuration to a single straight line occurred on March 10, 1982. Below are given the heliocentric longitudes for the planets on this date.

Plot these directions on a separate sheet, preferably unlined, with a protractor by marking the sun's location somewhere near the center of the page with an "x" or "o" and drawing a line in any arbitrary direction to represent your 0 degrees reference longitude. Identify the line at its end with 0°. Next, plot the planets' directions, identifying each line with the planet's name and degree. It's your choice to go clockwise or counterclockwise when starting to plot.

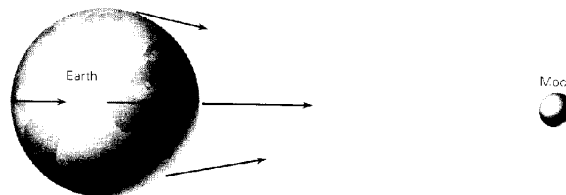
Mercury	265°	Saturn	198°
Venus	200°	Uranus	241°
Earth	170°	Neptune	265°
Mars	183°	Pluto	205°
Jupiter	212°		

(Taken from *Mercury*, July-August, 1979, p. 73. For direct ("horse's mouth") sources, see, e.g. "Tables of Planetary Longitudes", Stahlman and Gingerich and/or "Planetary Coordinates for the years 1959-1989", "Nautical Almanac Office, U.S. Naval Observatory, 1958.)

Response 1. (3 pts.) Based upon your plots, briefly comment in the space below, whether, and by how much, your results tend to support or refute the basic claim of a "superconjunction" of all the planets in 1982:

II A. THE TIDAL PULLS OF THE

PLANETS: Let's first understand tidal stretching. This is stress induced by the fact that gravity weakens with distance from the source. Here's how it works. Take the earth and moon, for instance. The side of the earth facing the moon, *being nearer to it*, feels the pull of the moon's gravity more than the earth's far side. The result is a stretching of the earth. The solid earth doesn't give much, but the water will tend to build up on the near and far sides of the earth. Any particular seacoast will, with the earth's rotation, move into and out of these built up areas of water and experience the well-known "tides" of water giving the name to this gravitational stretching effect.



Have you heard it said that mathematics is the language of science? Or have you heard me say that while *qualitative* descriptions are helpful in understanding some aspect of physical reality, you really need to know the relevant *quantitative* aspects and mathematical relationships to truly know the subject? Bottom line: You don't really understand the world without knowing the relevant math.

We come to a very good example of this here. This business about tidal pull is something you can grasp qualitatively as described in the above paragraph, i.e. you got the general idea. But to leave you only with that would enable the JUPITER EFFECT authors to "take" you, mislead you into thinking that a "superconjunction" line-up involving all the planets would be something significant. But would it really be? You can only find out by applying math to the situation. The equation below calculates the tidal pull on the sun by each planet. **YOUR ANSWER IS THE PLANET'S PULL RELATIVE TO THE EARTH'S PULL.** In the next unit (II B.) we'll learn what the earth's tidal effect on the sun actually is.

Tidal force increases directly with the mass of the gravity source and inversely with the *cube* (not square) of the distance from the source. It falls off pretty fast with increasing distance, doesn't it? For example, were the moon to somehow be moved to triple its average current distance, its tidal influence on earth would plummet by a factor of 27 (one-third cubed).

To enable you to calculate the tidal influence of each planet on the sun *relative to earth*, use the data in the table below and plug into the following equation:

$$\frac{F_p}{F_e} = \frac{m_p}{a_p^3} \quad \text{With } F_e = 1, \text{ then } F_p = \frac{m_p}{a_p^3}$$

The left hand side of the equation is what you want to determine — the ratio of a planet's tidal force on the sun to the earth's tidal force on the sun.

The right hand side of the equation shows how you get what you want. " m_p " is the planet's mass expressed in units of the earth's mass and " a_p " is the planet's distance from the sun expressed in units of Astronomical Units, the earth's average distance from the sun. You see that the right hand side is made of terms expressed in earth units; therefore your result—the left hand side of the equation—will also be a ratio expressed relative to earth's value. $F_e = 1$, so F_p/F_e simplifies to F_p .

Fill in the table with your results, BUT SHOW YOUR CALCULATION STEPS on the back of this sheet. Remember to write your name on it. Also, try to be neat. ROUND OFF TO THREE SIGNIFICANT FIGURES (example: 1.56), EXCEPT FOR PLUTO, whose mass value is known to only two significant figures, so likewise you show only two significant figures (example: 0.00049).

PLANET	DISTANCE FROM SUN	MASS	TIDAL EFFECT
Mercury	—	0.056	
(perihelion)	0.31		1.88 Check your calculation with this.
(aphelion)	0.47		
Venus	0.72	0.815	
Earth	1.00	1.00	1.00
Mars	—	0.107	
(perihelion)	1.38		
(aphelion)	1.67		
Jupiter	5.20	317.8	
Saturn	9.54	95.1	
Uranus	19.2	14.5	
Neptune	30.1	17.2	
Pluto (at perihelion in 1982)	29.7	0.0022	

Response 2. (1 pt.) Do the planets contribute about equally to the tidal strain on the sun?

Yes No

Response 3. (3 pts.) Using your numerical results above, state how significant it really is to have all the planets lined up, as opposed to having just the top four influencers aligned? Do/show the math below. Sum up the relative tidal influences of the top 4 influencers, followed by a summation of all the planets and compare the sums. (For Mercury and Mars, use their perihelion values.)

Response 4. (2 pts.) And what do you think of the authors' statement on p. 183 (again, from your numerical results for relative tidal pulls on the sun), "*From our point of view, one of the more important features...is that even tiny Pluto... between thirty and forty times as far from the sun as is the Earth, and much smaller than our planet, plays a part in the disturbances by which activity on the sun affects the Earth.*"?

II B. THE EARTH'S TIDAL PULL: Now that you see from your work above in part II A the relative importance of the planets in inducing tides on the sun, you must wonder what the effect on the sun is by the earth, the standard of comparison. Only knowing this can we know the overall effect of all the planets on the sun. Read on.....

Astronomer John Meeus (from "*Icarus*", vol. 26, pp. 257-267, 1975):

"The height of the tidal bulge is inversely proportional to the surface gravity, which on the Sun is 27.9 times that on Earth. Let us compare the tidal height on the Sun caused by the Earth to that on the Earth caused by the Moon. The Earth's mass is 81.3 times the Moon's mass. The Earth-Sun distance is 389 times the Earth-Moon's mass. The ratio of the two mentioned tides is thus

$$\frac{1}{27.9} \times \frac{81.3}{389^3} \cong \frac{1}{20,000,000}$$

Hence, on the Sun the height of the tidal bulge due to the Earth is 20 million times smaller than that caused by the Moon on the Earth. If we add the effects of all other planets, we still arrive at a bulge that is 2,700,000 times smaller than the tides on Earth. Even if we take into account the rigidity of the celestial bodies, this cannot represent sensible tides on the Sun. Melchier in 1975 even calculated that the height of the tidal "bulge" caused by Jupiter on the Sun does not exceed 1 mm. This is sufficient to prove that any speculation about planetary tidal effects on the Sun and on its activity is completely irrelevant."

Let's place a 1 mm expansion in context. Realize that a millimeter is about the length of the cross on this "t" and that the sun's diameter is approximately 1,400,000 km. Now, there are 1000 meters in a kilometer and 1000 millimeters in a meter, therefore 1,000,000 millimeters in a kilometer, for a grand total of approximately 1,400,000,000,000 millimeters from one side of the sun to the other! (This number is so large, why it's almost a *third* of our national debt, in dollars! Hmmm, that raises an astronomical problem of another sort...)

Further, turn to the Appendix, p. *i* to read a part of p. 175 of the college textbook **CONTEMPORARY ASTRONOMY**, for example, by Jay Pasachoff and read of the discoveries of the sun's oscillations. Pasachoff's text was published in 1977. Later editions do not substantially change this--read your own textbook. The discovery of solar oscillations was later confirmed and reported in the following 1979 Science News article on p. ii.

Response 5. (5 pts.) So with all the above in mind, what do you think now of the validity of the idea that the planets tidally influence the sun? Support your opinion with quantitative evidence you have generated and from this section.

III. OTHER SIGNIFICANT POINTS: There is a basic fact about the solar system that you should take away with you after this course, and that bears on this Jupiter Effect claim. This fact will give a perspective that the "Ph.D. astronomer-authors should have had in the first place. To find this fact, turn to the Appendix, p. *iii* to see Table 11.1 of George Abell's 1980 text REALM OF THE UNIVERSE and note the value given there for the mass of the Sun relative to the total mass of the entire solar system. Write it here.

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Let's take a look at one more aspect of the Jupiter Effect theory — that these so-called superconjunctions occur every 179 years (mentioned in part A 1.), and use this fact to support or refute the validity of part A 3 of the Jupiter Effect chain of reasoning. This is the part that predicts really huge sunspot maximums because of the planets. We'll do this by examining the sunspot cycle graph (Appendix, p. *iv*) for the year 1803 (=1982-179) and note down the number of sunspots for that year.

Response 6. (3 pts.) Examining the graph, comment on how the number of sunspots in that year and the peak just after 1803 compare or contrast to the counts of other sunspot maxima. Does this support the Jupiter Effect or suggest otherwise?

No work regarding points B-4, 5, 6; but note the following:

1. Earthquake records for 1803 indicate no unusual number of great earthquakes. Nor for 1982.
2. The reasoning of the authors here is plausible, but with only weak supporting evidence which allows the tying of these ideas together. Taken individually, some of the ideas may be okay, but we don't at this point really know one way or the other. As always in such cases, the burden of proof is on those making the assertions. But remember: A chain is only as strong as its weakest links.

And finally, for the *coup de gras*, read the Appendix, pp. *v* and *vi*. This is an article which appeared in the June 1980 issue of OMNI magazine. This was the same year, incidentally, in which the sunspot maximum actually did occur.

Response 7. (5 pts.) As a final activity, outline or summarize on another sheet the major points in the OMNI article. Note particularly who wrote it. (I expect to see side of a sheet or a bit more of notes.)