Nemesis

Horace Heffner
(Combined and edited posts from March 2004)

It has been speculated at various times that a cloud or swarm of asteroids and comets exists which tends to all return at once. Such a swarm could be created by various means. One is that a heavy but fairly dark object, a dark or small star might periodically traverse or might have at some time traversed our neighborhood and disrupted the Ort cloud, sending numerous bodies sunward at the same time. Another hypothesis is that a planet exploded. In particular, the planet that exploded, or disintegrated due to a major impact, might have existed between Mars and Jupiter, where the asteroid belt now lies. In that case debris might be all over the solar system. However, the more extremely energetic fragments would end up having orbits with large eccentricities, and long orbital periods. None of this is new. The swarm has been referred to as the Nemesis Swarm, or Nemesis Cloud.

A Nemesis Swarm might explain some extinctions for which no major impact area has been found. That is because the extinction might have been caused by many smaller impacts of which there is no obvious geologic record.

Of much more interest is the possibility that meteor impacts may play a role in solar activity, and even sunspots. The motion of the plasma of the sun is governed by complex differential equations, in a manner somewhat like terrestrial weather, yet that motion is far more complicated than the weather due to the system not being merely mechanical, but also electromagnetic, as well as far more energetic. Therefore asteroid or comet impact on the sun is a prime candidate to cause the Butterfly Effect, the effect where a very small perturbation can result in large feedback cycles that produce large events. The effect is so named because it is said the flap of a butterfly's wing can be the ultimate cause of a hurricane.

It may be possible that a swarm of nearly simultaneous impact events on the sun, even though not directly upon the earth, could affect the weather for long periods, and even initiate or change the sunspot cycle frequency. Such a solar event would produce limited geological evidence of its existence, and even less of its cause, yet could in fact cause a major extinction.

If the earth fell into the sun it should vaporize fairly fast due to its kinetic energy and high internal solar density. Using 1.979E30 kg for mass of sun and 860,000 mi for diameter, or 6.92E8 meters, we get an escape velocity = sqrt (2Gm/r) = 6.18E5 m/s for the sun. That gives energy/gram = 0.5*(1 gm)*(v^2)/(1 g) = 1.9E8 J/g, or 190 megajoules per gram, or about 29000 times the heat required to vaporize the iron.

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That's a total collision energy of (1.9E8 J/g)(6E27 g) = 1.14E36 J. The sun's output is only 3.8E26 J/s. The collision energy is thus 2.9 billion seconds, or about 91 years of solar heat output. If that kind of energy were radiated even over the period of a year, due to some earth sized body hitting the sun, the earth would be a very crispy critter.

This shows why a Nemesis cloud need not produce earth impacts to produce major extinctions. A sufficient tonnage of solar impacts would be plenty good enough. They should be capable of generating large solar flares and thus, if nothing else, momentarily greatly increasing the solar radiating area.

Since the earth has a 200 My (million year) galactic orbital period, it should cross the galactic plane in opposite directions once every 50 million years, once every 100 My in the same direction. The premise of 100 My nemesis returns is roughly consistent with the commonly accepted major extinctions, on average. Major extinctions occurred about 6 times in the last 600 million years, as shown in Fig. 1, so 100 My intervals is about right in average terms.

Age	Period	Interval	
Cambrian	570-500	70	*
Ordovician	500-430	70	*
Silurian	430-395	35	
Devonian	395-345	50	*
Carboniferous	345-280	65	
Permian	280-225	55	*
Triassic	225-195	30	*
Jurassic	195-136	56	
Cretaceous	136-65	71	*
Tertiary	65-present	65	

* general agreement on extinction

Fig. 1 - Ages, Periods, and Interval lengths (My)

There are essentially 5 extinction events in each of the last two 300 million year periods (600-300, 300-present).

If we take only the periods in which it is generally agreed that major extinction events occurred we get the pattern in Fig. 2.

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Age	Start	Interval
Cambrian	570	70
Ordovician	500	105
Devonian	395	115
Permian	280	55
Triassic	225	89
Cretaceous	136	136

Fig. 2 - Extinctions Ages and Intervals (My)

In this perspective there are 3 events in each of the last 300 million year periods, or on average one event every 100 million years. Noting the last line of Fig. 2, are clearly overdue.

The main problem with this theory is the lack of extinctions in the Pre-Cambian period. That fact leads one to believe a one time perturbation about 600 million years ago must have started the process. It may be possible our solar system got gravitationally entangled with a partner Nemesis rock or cloud that orbits at the same galactic radius but typically occupies approximately the opposing galactic latitude.