Volume 3, Issue 2 February 2008

$ 4.95

Science Newsletter February 2008

Two to Tango ?

Our Sun's unseen companion

A. Shepherd

Special points of interest:

- Sol's friend
- Triton Fun stuff
- Superfluous questions

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Bright, massive stars like the Sun are most often found in multiple star systems. Particularly common are binaries, two stars that are gravitationally bound, orbiting a common center of mass. So might our Sun be part of a binary star system, locked forever in a tango with a shy companion that has not yet been discovered?

It's an idea that has been around for several decades and just won't go away. In 1975, K. Davidson of the University of Minnesota raised the possibility that one of the many dwarf stars in our Milky Way galaxy might be associated with our solar system. *Lucifer* ("light bringer"), as he named the hypothetical solar companion, would orbit at least 700 times the earth's distance from the sun – more likely thousands of times that distance, he thought. Its mass could be as much as one hundredth of the Sun's without perturbing the outer planets noticeably. Davidson observed that binary stars with such a large separation are not unusual and suggested that such a companion might even explain the peculiar orbits of comets. As comets travel to the outer reaches of the solar system, *Lucifer* would either disperse them or perturb them to their observed eccentric orbits.

In 1977, E. Harrison studied an anomalous grouping of pulsars in a relatively small region of the sky, roughly in the direction of the galactic center. He suggested that the solar system's *barycenter* is possibly being accelerated in that direction, because the Sun might have this companion. Such a hypothetical companion, he argued, might be either a faint white or red dwarf in a closed orbit around the Sun, or a gas-accreting nearby neutron star or black hole in orbit. However, other astronomers disagreed with his explanation concerning the grouping of the pulsars, and so his theory about possible causes for their clustered distribution also remained controversial.

But the idea of a partner for the Sun was still considered a strong possibility by others. In the 1980s, shortly after the theory was proposed that it was a giant impact that wiped out the dinosaurs, researchers noted that mass extinctions on Earth appeared to occur at regular intervals. Specifically, University of Chicago paleontologists who studied fossil records over a 250 million-year period found significant spikes in extinctions every 26 million years. Could these extinctions be explained by impacts, and what could possibly account for their periodicity?

According to R. Muller of the University of California, the explanation might be that the Sun has a companion star. He named the hypothetical companion *Nemesis*, after the Greek goddess of doom, and suggested that it could be a red dwarf, the most common type of star in the galaxy. Its orbit would lie one to three light years away from the Sun. On its closest approach, Muller argued, Nemesis would pass through the Oort cloud, a halo of dust and ice left over from the formation of the solar system. In this "cloud," the nuclei of 100 billion comets orbit the Sun from beyond Neptune's orbit out to nearly a light-year away. During the passage through or near the Oort cloud, the solar companion's gravity would dislodge millions or billions of these comets from their orbits. Then, over millions of years, the wayward comets would travel to the inner solar system, attracted by the Sun's gravity. Along the way, a few would collide with the Earth, causing the regular mass extinctions. Fortunately, the next comet shower is not expected for another 14 million years.

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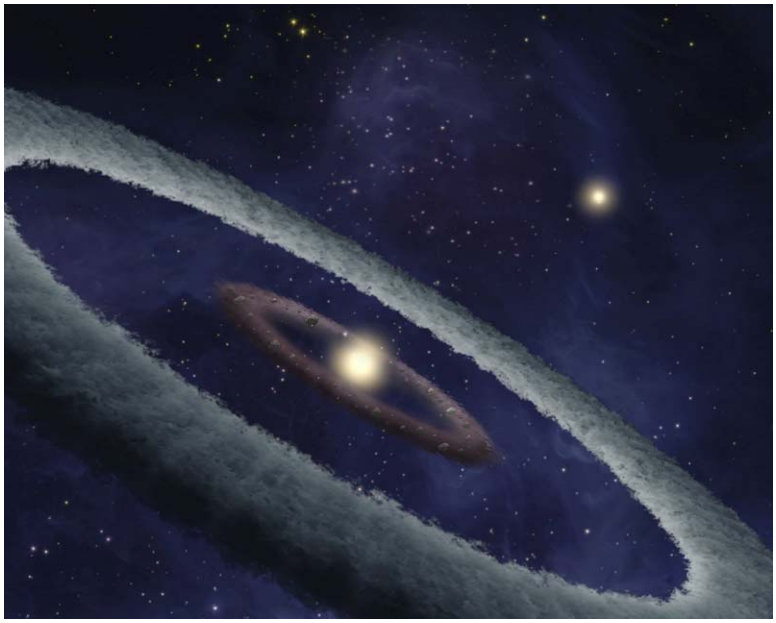
The Sun's unseen companion: continued

Photos/Info: NASA/Caltech/Spitzer Science Center

Many researchers dismissed Muller's theory. Some were skeptical because no binary has ever been found whose stars are so distant from each other. Others preferred alternate explanations for the impacts that cause mass extinctions. For example, comets from the Oort cloud might also be knocked out of orbit by the variation in gravity of the gas and dust in the galactic plane as the solar systems revolves around the galactic center.

But, like extinctions on Earth, the theory of a solar companion gains strength periodically. In 2006, Caltech astronomer M. Brown discovered a planetoid which might be orbiting around a solar companion. *Sedna*, as he named the small planet, moves in a highly unusual elliptical orbit, but never comes close enough to be affected by the Sun. According to W. Cruttenden of the Binary Research Institute, it so happens that Sedna has an orbital period of 12,000 years, which is in resonance with the expected orbit periodicity of the hypothetical companion star.

Additional recent support for *Nemesis*, or whatever we choose to call the hypothetical solar companion, comes from the debris disks found around two stars that are around 60 light years away. In a Hubble Space Telescope survey, University of California researchers discovered that the disks have a sharp outer edge rather than expanding outward gradually. This might be explained by an unseen companion's gravity that keeps the disks from spreading. And since these disks look much like the Kuiper Belt in the outer reaches of our solar system, the same explanation might apply here: The sharp outer edge of the Kuiper Belt might be due to a solar companion which keeps the disk confined.



Artist's impression of a two-star system

This image portrays a binary star system that may be existing in HD 113766. The rings contain rocky and icy material from which an Earth-like planet is being formed. HD 113766 is about 424 light-years away from Earth. Observations by the Spitzer Space Telescope determined that the binary-star system may look something like this. In this system, only one of the stars has a ring of rock and ice-containing material around it. The ring material will first stick together to make planetesimals (smaller bodies that are the ingredients of planet formation) and these pieces may eventually possibly coagulate into a watery, habitable planet.

And so, support for Nemesis has grown over the years. But, if ultimately it turns out that the Sun is a lonely wallflower, we can always give it a dancing partner by igniting the hydrogen atmosphere of Jupiter. The idea has already been proposed by science fiction writer Arthur C. Clarke and it would not be the first time that science fiction has become reality.

Resources:

Is Lucifer a partner to the Sun? Anonymous, New Scientist **68**, 373, 1975.

Has the Sun a companion star? E. Harrison, Nature **270**, 324-326, 1977.

Nemesis: Does the Sun have a companion? R. Britt, 2001, http://www.space.com/scienceastronomy/solarsystem/nemesis_010320-1.html

Evidence mounts for sun's companion star, http://www.physorg.com/news65117758.html

Star systems hint at possibility of Sun's Nemesis, http://www.space.com/scienceastronomy/060119_kuiper_stars.html

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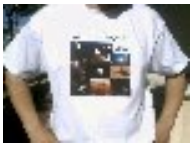

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Superfluous Questions:

1. Who did the voice of Rocket J. Squirrel in the "Rocky and Bullwinkle" cartoons ?

   a) George O'Hanlon b) Mel Blanc c) Bea Benaderet d) June Foray

2. In what month does the Geminids meteor shower occur?

   a) September b) May c) November d) December

3. In 1979, the Pioneer 11 spacecraft discovered a new moon of Saturn because its radiation detectors suddenly dropped to zero and the magnetometer readings went wild (this is because moons absorb radiation). At the time, the new moon was nicknamed the "Pioneer Rock". What is the real name of Saturn's moon discovered by Pioneer 11 ?

   a) Pan b) Atlas c) Epimetheus d) Methone

4. One of the smartest monkey species are the Capuchin monkees, also called the "organ grinder" monkeys. They are social, intelligent, and have even been used to help handicapped people with chores around the house. Where do Capuchins live ?

   a) Africa b) Madagascar c) South America d) Brooklyn

—-> ANSWERS in next months issue of the Science Newsletter ! <——-

** ANSWERS to January's Superfluous Questions: 1. c) Philadelphia 2. c) doctor 3. c) Paul Williams 4. b) Leonard