

70 Ophiuchi – Realm of Orange Suns

by Steven C. Raine

There is darkness of a perfect night sky all around except for an orange glow coming from twin spheres of light like sun-sized mandarins. The effect is almost like streetlights hidden in the dark and blurred to roundness by thick fog. Yet from here stars are visible everywhere and not the stars of home although surprisingly similar. A clue to the location is the way the stars nearest our own Sun have shifted, Sirius, Procyon and Alpha Centauri the most notably displaced and altered in radiance. Towards Orion is an unfamiliar star of third magnitude which happens to be a G2 type star—the Sun of humanity (Dole, 1964). This is the environs near 70 Ophiuchi, a binary star located amongst the closest of our celestial neighbours a meagre 16.5 light years away.

Despite being a faint and inconspicuous star, 70 Ophiuchi was once given the distinction of forming part of the separate small, now defunct constellation known as “Poniatowski’s Bull” which consisted of a V-shaped group of stars, slightly reminiscent of the Hyades, as shown in Figure 1. 70 Ophiuchi is a fourth magnitude star located on one side of the “Polish Bull” asterism. It is adjacent to Beta Ophiuchi—known as Cebalrai or Cheleb—in the same area which boasts the presence of Barnard’s Star. As Motz and Nathanson note the “Polish Bull”, or “Taureau Royale” as the French referred to it, was a short-lived but interesting little constellation:

“...its brief history began in 1777 when the Abbe Poczobut of Wilna, a Polish astronomer, asked the French academy to honor King Stanislaus Poniatowski (the Polish King) with a constellation.”

Poniatowski’s Bull was the result, but it “became obsolete by the end of the nineteenth century” (Motz & Nathanson, 1991). Strangely enough the same stars were also held to

be a separate constellation by the Arabians, judging by a 13th century globe “now resting in the Borgian museum at Villettri.” (Motz & Nathanson, 1991.)

The nearness to our Sun is however only a small part of this star’s renown, for 70 Ophiuchi is best known as a binary star system. As you can see from Figure 2, the two stars orbit their shared centre of gravity—the barycentre—in 88 years. An orbital period which Dole notes is “almost identical with ... Alpha Centauri A and Alpha Centauri B.” The primary star 70 Ophiuchi A is a K1 type main sequence star with an absolute magnitude of +5.8 and the secondary star 70 Ophiuchi B is another orange dwarf but somewhat fainter with an absolute magnitude of +7.3 and a spectral class of K5. This duality has been known since 1779 when it was revealed by Sir William Herschel.

However, more intriguing is the possibility that 70 Ophiuchi has components as yet undiscovered. In his report on the possibility of habitable planets Dole noted “No third companion has been established for the system although dark companions are suspected.” The controversy began in 1842 with J.H. Madler was the first to note deviation from Keplerian motion (Robert Burnham Jnr., 1978). One of the earliest reports on these suspected dark companions caused a kerfuffle leading to the collapse of the career of one of the participants. Excitement reached a peak in 1899, when American astronomer T.J.J. See proclaimed that “certain apparent irregularities in the orbital motion of ... 70 Ophiuchi were explained by the companion having a massive dark satellite moving about it in a 36-year period.” (Ashbrook, 1984). This report was attacked by a mathematical astronomer named Moulton in a paper which showed that such a system would be highly unstable and could not exist. Consequently See wrote an ill-considered letter to the *Astronomical Journal* that led to his life-long disbarment as a contributor (Ashbrook). This affair was a major factor in the destruction of See’s life—he later suffered a nervous breakdown, and his eventual fate was to remain trapped until his death in the ruins of his career (Ashbrook).

This episode was not the end of the speculation over a third component to 70 Ophiuchi for since Madler’s initial finding many others, including W.S. Jacob in 1855 and T. Lewis in 1906, have reported anomalies in the orbit. Despite attempts to cast doubt on the measurements by Dr Strand in 1937 this puzzle refuses to die. A study of astrometric plates carried out in 1943 revealed “indications of a 17-year perturbation with an amplitude of about 0.015 arc seconds—the mass of the assumed third body would be about 1% of one solar mass. At present it can only be said that more observations are needed to settle the question” (Burnham, 1978). My most recent information on this debate is that as of 1991 it was observed that “the presence of a third body in the system is suspected, possibly a planet about ten times Jupiter’s mass, but the unseen planet’s existence has not yet been confirmed.” (Motz & Nathanson). Perhaps this is

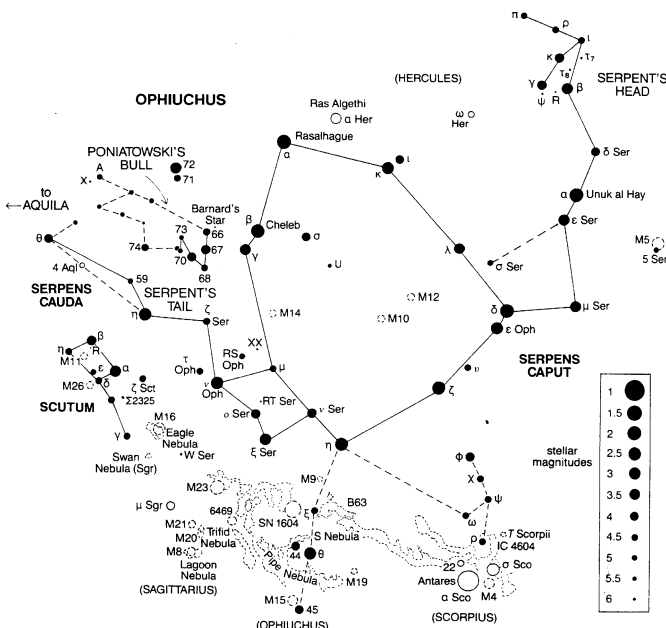


Figure 1: Ophiuchus and vicinity—showing the location of “Poniatowski’s Bull” asterism and 70 Ophiuchi.

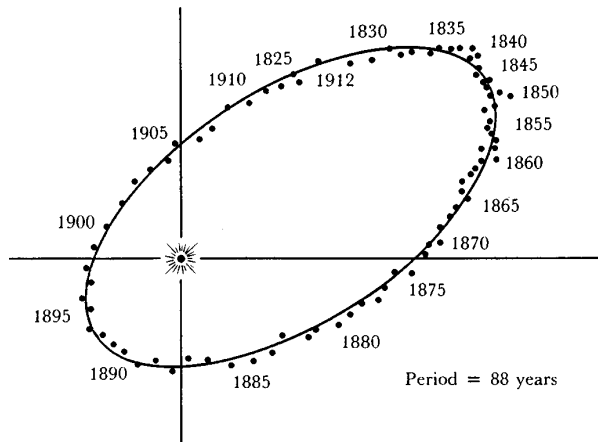


Figure 2: The orbit of 70 Ophiuchi (Kaufmann, 1990).

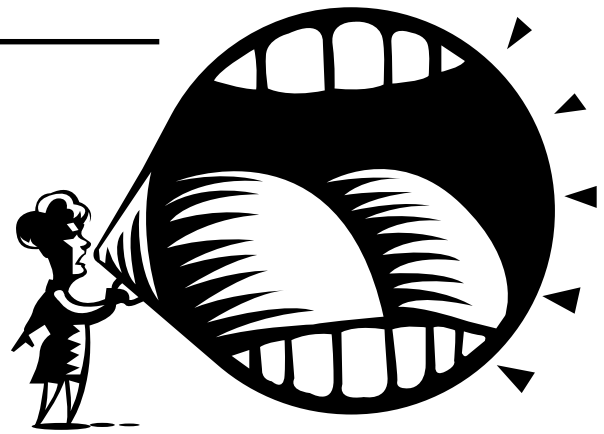
► one mystery we may see resolved soon given the new revelations on extrasolar planets discovered around 51 Pegasi et al. Maybe the Hubble Space Telescope could be used for that purpose? If found, any planet around 70 Ophiuchi would be the second closest known behind Lalande 21185.

For one thing, a commendable study on the possibilities of habitable planets done in 1964 by Stephen Dole, rates 70 Ophiuchi A as having a probability of 0.057 of possessing a habitable planet—1 chance in 18. If the 70 Ophiuchi system has one planet of Jovian nature, it would seem likely to have more and the chance of an earth-like planet existing seems more plausible—if well-nigh impossible to determine. The fact that 70 Ophiuchi A is in a binary system doesn't automatically preclude this possibility because the two stars have orbits which should allow planets to orbit in the ecosphere—the narrow area where water can be at its triple point and thus can sustain life (Dole). At their closest the two stars come to within 11.4 AU and at their furthest they are 34.2 AU distant, even at periastron that should give sufficient space especially given that the ecosphere of 70 Ophiuchi A will be closer in to the star than our Sun's 1 AU region owing to the orange dwarfs dimmer nature. This coolness however probably goes too far in the case of 70 Ophiuchi B giving the secondary star little chance of supporting a habitable planet due to its cooler spectral class.

Is there any truth in these speculations? We may never know unless we find a way to visit, and yet I cannot help going back to the scene visualised in the first paragraph. As the two bright orange suns shine down, dimmer but strangely similar to the Sun, the vision pans to a globe covered with blue and white, an Earth-like planet circling the realms of the orange suns. Strange shadows lit from two angles in peculiar light dapple the world's surface, and as we investigate the landscape we find... the unknown.

References:

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- Dole, Stephen, *Habitable Planets for Man*, Rand Corporation, 1964.
- Burnham, Robert Jnr., *Burnham's Celestial Handbook*, Dover publications, 1978.
- Ashbrook, Joseph, *The Astronomical Scrapbook*, Sky Publishing & Cambridge University Press, 1984.
- Kaufmann, William, *Discovering the Universe*, W.H. Freeman & Co., 1990.



Announcing the ASSA Home Page!

After several of months of discussions and planning the Astronomical Society of South Australia now has its own Home Page on the Internet. At present, the primary purpose of the site is to increase the awareness of the Society to the Internet community—both local and global. To this end the site contains information about our history and aims, our meetings and viewing nights including dates, times, venues and how to get there, articles from recent issues of the Bulletin and membership information. As it exists at present, the site is very much an extension of the Society's information and membership brochure.

Like all Internet sites the ASSA Home Page will evolve with time and here the emphasis will be on providing additional benefits to the "connected" members of the Society. This will likely include the rapid dissemination of astronomical news, finder charts, data, and software. Let us know if you have any ideas on what else the site should contain. Note, a gallery of astrophotos taken by members will soon be available.

The URL address of the ASSA Home Page is:

<http://www.gist.net.au/assa>

and the Society's e-mail address is:

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Please take a look at the home page, add it to your bookmarks, and e-mail us your thoughts. If you don't have Internet access then try your local library—they may just provide Internet access.

Finally, a big thank you goes to **Phillip Pudney** for arranging the Society's Internet connection with **Global Link Internet Services and Training**. Thanks, Phillip!

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