Blue moon

The Urth list — 4 messages, 2 voices, 25 Mar 2002

https://urth.darkrealm.vip/thread/urth/3087

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Roy C. Lackey — 25 Mar 2002, 23:19

This occurred to me last night, and I took it to mantis first today, and he said to post it all to the list, so here it is:

> You should post this to the list!
>
> You seem to like to take a sliderule to things, so consider this observation. I'm about 3/4 of the way through IGJ, in my re-read of the SS series. While I am not fond of the idea of Urth=Blue/Lune=Green, and my observation doesn't compel that reading, if I'm correct, then Blue and Green
> are linked in a way that I can only account for if one is orbiting the other. In other words, Blue and Green can not be independent bodies orbiting
> the sun in the manner of, say, Mars, Earth, and Venus.
>
> IIRC, we are told at the beginning of OBW that conjunction is two years away. We are also told that at its closest approach, at conjunction, that Green is some 35,000 leagues (105,000 miles) from Blue. Conjunction took place while Silkhorn was in Gaon. The war between Blanko and Soldo took place only a matter of weeks after Silkhorn left Gaon. During that war, Sfido told Incanto that Gagliardo had calculated that Green was then over 80,000 leagues (about 250,000 miles) from Blue. Hide, at about that same time, told Incanto that Horn had been gone for three years. Therefore, at that time, conjunction was one year past. Therefore, in the year since conjunction, Green had diverged only about 145,000 miles from Blue. We are told that conjunction occurs every six years.Therefore, at the mid-point between conjunctions, Green would have to be at its greatest distance from Blue. Orbital velocities tend to remain fairly constant, afaik. So, based on
> the numbers above, Green would never be more than about 540,000 miles from Blue.
>
> Velocities are a little tricky in that they do change: it is "equal area in equal time," with the "area" in this case being the triangle created by planet at point 1, point 2, and the primary star. Line between point 1 and point 2 being the segment of the orbit. The world does speed up at closest encounter and slow down at furthest point.
>
> So anyway, we are given that the closest is 105,000 miles, and you are saying that based on the movement in one year the maximum separation is 540,000 miles; the average would be 322,500 miles.
>
> I'm no expert on celestial mechanics, but I find it hard to believe that two
> planets, effectively in the same orbital plane and the same distance from the sun, could exist that close together without the planets orbiting each other, or one body being a satellite of the other. No? Where am I wrong?

Is

Green Blue's moon?

I'm no expert, but I do like to play with these things. In the past I wondered online whether it could possibly be that weird "dosey-do" trick that some of the Jovian moons do--two worldlets in the same orbit, they swing by each other and exchange orbits: the slightly lower/faster one changing places with the higher/slower one. This is a boggling thing in the real world!

It doesn't seem to match Blue/Green, because it would happen every year or less.

Today, with your new numbers, I'm wondering if Green is in a weird orbit between Blue and Blue's "trojan point." Because otherwise it is very difficult to see how a normal satellite could take six years to come so close and then back off again. (No, the trojan point idea is impossible: the trojan point is where forces are cancelled out--it is not a gravity point, and as such it has no attraction)

In dealing with satellites it is often handy to use "planetary radii." If we give Blue a radius of 3960 miles (ala Earth), then hey!

Roy's Green Orbit
105,000 miles = 26.51 radii
322,500 miles = 81.44 radii
540,000 miles = 136.36 radii

A large moon is expected to orbit an earthlike planet between 10 and 80 radii, so this looks quite promising! (FWIW the Roche Limit is around 2.89 radii: that point where worlds are torn up into confetti.)

Orbital period (in days) for moon = .0074 * sqrt (R^3/M)

Where R = orbit in thousands of miles
Where M = sum of planet and moon in Earth masses.

Figuring that Green is equal to Blue, then let M = 2.

This gives an answer of . . .

30 days.

6 years = 2191.5 days

We can solve this for M, which would then give us the mass of Green!

Shot in the dark: M = 1.5 . . . 35 days.

Shot in the dark: M = 1.16 (like Earth + Mars) . . . 40 days.

Third shot: M = 1 . . . 42.86 days

Well, there's that old problem again! If Green is a satellite of Blue, orbiting at 322,500 miles, it should complete an orbit in 43 days!

Maybe you should post all of this to the list--I didn't think I'd get so wrapped up in it so quickly.

=M=

-Roy

Adam Stephanides — 28 Mar 2002, 21:20 · follows Roy C. Lackey

on 3/25/02 5:19 PM, Roy C. Lackey at rclackey at stic.net wrote:

Thanks for digging these figures up! They indeed present serious difficulties.

> IIRC, we are told at the beginning of OBW that conjunction is two years away. We are also told that at its closest approach, at conjunction, that Green is some 35,000 leagues (105,000 miles) from Blue. Conjunction took place while Silkhorn was in Gaon. The war between Blanko and Soldo took place only a matter of weeks after Silkhorn left Gaon. During that war, Sfido told Incanto that Gagliardo had calculated that Green was then over 80,000 leagues (about 250,000 miles) from Blue. Hide, at about that same time, told Incanto that Horn had been gone for three years. Therefore, at that time, conjunction was one year past. Therefore, in the year since conjunction, Green had diverged only about 145,000 miles from Blue. We are told that conjunction occurs every six years.Therefore, at the mid-point between conjunctions, Green would have to be at its greatest distance from Blue. Orbital velocities tend to remain fairly constant, afaik. So, based on
> the numbers above, Green would never be more than about 540,000 miles from Blue.

This last bit doesn't follow. It's true that orbital velocities tend to remain fairly constant if the orbit is approximately circular. But it doesn't follow that the rate at which the distance between two planets changes remains fairly constant (and indeed, it doesn't). But still, your numbers do indeed rule out the idea of Blue and Green having independent orbits around the Short Sun, I think.

Suppose that they do have independent orbits. Conjunction is every six years, so six Blue years equal either five or seven Green years. Hence the time between conjunction and Gagliardo's observation is either five-sixth or seven-sixth of a Green year. In either case, the distance between conjunction and the position Green is in at Gagliardo's observation (call it position A) is the distance Green travels in one-sixth of a Green year.

Now at conjunction Green is 105,000 miles from Blue. At position A Green is 250,000 miles from Blue. Hence position A cannot be more than 355,000 miles from conjunction (actually, we could get an even better estimate, but it's not necessary). If Green's orbit is approximately circular, then simple geometry (think a regular hexagon) shows that Green's distance from the Short Sun itself can't be more than 355,000 miles, with Blue's distance not much more: that is, less than twice the distance from the Earth to the Moon.

This is impossible. Even if we posit that the Short Sun is a very small, dim star, the numbers don't work. Mantis's formula for the orbital period of a satellite was:

Orbital period (in days) for moon = .0074 * sqrt (R^3/M), where M is the combined mass of the two bodies in Earth masses.

Applying this to Blue and the Short Sun, and assuming Blue's year to be close in length to an Earth year, we find that for Blue to be less than twice the distance from the Short Sun that the Moon is from the Earth, and yet have an orbital period twelve times as long, the total mass of Blue and the Short Sun would have to be a small fraction of the Earth's mass.

As mantis points out, when orbits are not circular orbital velocity is not constant, so by

assuming that Green's orbit is eccentric we can push Green and Blue farther out. But doing so raises other, insuperable problems. Say we want to push Green at conjunction, and hence Blue, out to 35 million miles. This is probably still too close, assuming the Short Sun is approximately like our own (Earth is 83 million miles from the sun, iirc), but it's convenient to work with, and more than sufficient for our purposes. If Green is 35 million miles from the Short Sun at its farthest point, its orbit must be at least 70 million miles in length. Since Green goes 355,000 miles in a sixth of a year, it is covering 1/200 of its orbit during this period. In other words, Green's orbital velocity near conjunction is about 1/33 of its average velocity. As mantis says, planets sweep out equal areas in equal times. This means, if I'm not mistaken, that

orbital velocity at perihelion distance from sun at apohelion
---------- = ---------- orbital velocity at apohelion distance from sun at perihelion

Hence, Green's distance from the Short Sun at perihelion can be no more than 1/33 of its distance at apohelion, or approximately one million miles. The complex flora on Green could not possibly survive such an eccentric orbit.

What about combining a reasonably eccentric orbit with a small, dim, Short Sun? Some very rough calculations (which I won't bother to write down) suggest that that won't work either. Even if Green is twice as far at apohelion as it is at perihelion, this gets the Short Sun's mass up to more than Earth's mass, if that. (It might be objected that if Blue were Ushas, than the Short Sun might be the "bare" White Fountain. But what would have caused the sun to shed over 99% of its mass, without rendering Ushas and Lune uninhabitable?)

Mantis's outer Green can't help us either. That would mean that Green was nearest to the Short Sun at conjunction, meaning that it was going fastest at that point, not slowest, which just makes things worse.

So if these figures are correct, Green and Blue can't have independent orbits. But I still don't see how it's possible for Green to be a satellite of Blue and have "conjunction" every six years: i.e. a six-year "month." For that matter, if Green's "orbital period" around Blue is six times as long as Blue's orbital period around the Short Sun, in what sense can Green be said to be a satellite of Blue at all?

I see four possibilities:

1) Green is in one of the "strange orbits" me and mantis discussed some time back (the discussion should be in the archives somewhere).

2) The time indications are only approximate, and the time between conjunction and Gagliardo's observation was really much less than a year. Are there any mentions of the seasons? Or has somebody put together a chronology for TBOTSS? If one was posted here, I've forgotten.

3) Gagliardo was talking through his hat, and his distances bear no relationship to reality.

4) Wolfe didn't care about the astronomical plausibility of his "solar system," any more than he did about the physiological plausibility of his inhumi reaching escape velocity unaided.

I'm leaning more and more towards 4).

--Adam

Roy C. Lackey — 29 Mar 2002, 05:44 · follows Adam Stephanides

> From: Adam Stephanides <adamsteph at earthlink.net>
> Date: Thursday, March 28, 2002 3:19 PM
> Suppose that they do have independent orbits. Conjunction is every six years, so six Blue years equal either five or seven Green years. Hence the time between conjunction and Gagliardo's observation is either five-sixth or
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> This is impossible. [snip]

Huh? I don't follow that. Gagliardo's numbers don't say anything about the length of either body's solar orbit that I can see. His numbers indicate that at your position A the two bodies have _diverged_ by about 145,000 miles since conjunction. In that one year interval both bodies have also circumnavigated the sun. Two years later Blue and Green will have attained maximum separation, a distance af about 540,000 miles, then start gradually getting closer together until the next conjunction.

In other words, for the two bodies to be in independent orbits, those orbits would have to be almost congruent--almost, but not quite. Think of the two bodies as twin planets, traveling almost in tandem around the sun. The attraction of one body for the other causes minor changes in their orbital velocities, which average out over a six-year cycle, but account for the fluctuation in distance between the two bodies during the cycle. Or am I missing something so obvious I can't see it?

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> of Blue and have "conjunction" every six years: i.e. a six-year "month."
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> I'm leaning more and more towards 4).

That seems to be where most here who have an opinion about it are leaning. I would tend to agree--but, Wolfe could have avoided the whole thing by invoking some kind "magic" and just left out those numbers, which certainly weren't necessary to the plot.

-Roy

Adam Stephanides — 29 Mar 2002, 20:04 · follows Roy C. Lackey

> on 3/28/02 11:44 PM, Roy C. Lackey at rclackey at stic.net wrote:
> From: Adam Stephanides <adamsteph at earthlink.net>
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I was treating Blue and Green as analogous to Earth and Venus: completely independent orbits which remain fixed (i. e. don't oscillate). What you describe is more like mantis's twin moons chasing each other.

But I think it's probably hopeless to try and figure out what, if anything, Wolfe had in mind.

--Adam