

The Science of the Pendulum Sun

by Jeannette Ng

Much of the world building in my novel, *Under the Pendulum Sun* is fantastical but one detail got a remarkable amount of scientific attention and that is the sun itself.

It began as a simple bit of weirdness, that it would be interesting to have a sun that worked like a pendulum above a flat plane of a ground. This itself is rooted in making literal the idea that fairies are behind natural phenomena like milk spoiling and frost on glass. Their world is magically built to be like ours but not. So their sun, their moon, their seasons would be like ours but not.

However, as the idea of the pendulum sun grew, I wanted to work out what effects this would have on the physical world and sprinkle some science into the mix.

So I went and cornered the nearest approximation of a physicist¹ to interrogate about how this would work.

We have a sun on the end of a very, very long string above a flat plane of a world: what then?

Pendulums (or to be more exact, harmonic oscillators. These include systems such as pendulums, masses on strings, and twanged rulers) underpin a staggeringly large swathe of physics. There is a reason physics courses cover them, however boring first year students may find them.

First, the question came about how long I wanted periods of brightness and warmth would be, and given I wanted them analogous to earth days in length, the rod holding the pendulum in place would have to be very, very long. The maths spat out that my massless rod would need to be 300 earth radii in length, give or take.

The physicist notes that this is a number that always seems wrong. He rechecks this calculation almost every time it comes up, though the odd thing is that he can't entirely say if he was expecting a bigger number, or a smaller one.

Second, we started working out the length of "days" and "nights" at different parts of this landscape. A great many wobbly graphs were produced and the upshot is that everything would be too bright. Because of quite how light sensitive our eyes and the fact that pendulum sun never disappears behind anything, there would seemingly be always light. The exact light levels would vary from midsummer's day to murky day, but it would not ever

¹ "Physicist" is apparently a little bit of a stretch. He finished his research days a few years ago and "moved into industry" (a phrase which, in academia, is often spoken in the hushed tones normally reserved for the subject of the departed).

be night. Light travelled really very too well for my world to have any semblance of decent day/night cycle and what is the gothic without night?

The physicist interjects at this point with a comparison with Pluto, that despite it being really very, very far away from the sun, its surface is still bathed in light levels similar to our twilight. NASA calls this moment during dusk and dawn Pluto Time, when the illumination on Earth matches that of high noon on Pluto. There's [a calculator for pinpointing that moment where you are](#).

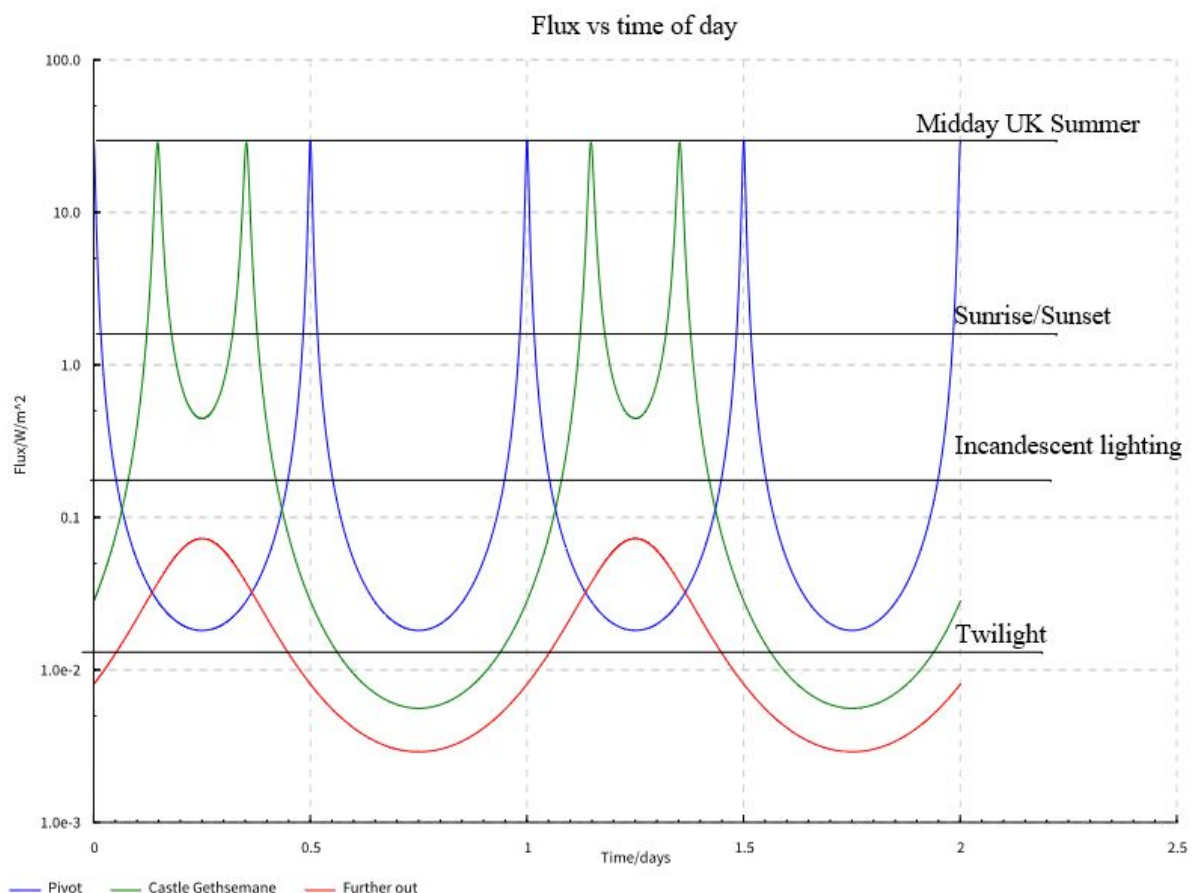


Fig: Flux vs time of day - Pivot is the city at the centre of Arcadia, and is directly below the Pendulum at rest. Gethsemane is the castle in which most of the action of Under the Pendulum Sun takes place. Further Out is simply a location beyond the furthest point of the Pendulum's arc, after it was decided that we were to place Arcadia on a functionally infinite plane rather than confine it within a dome or any other construct.

We discussed a variety of solutions to the darkness problem including options including tinkering with more fundamental laws of, much like how light travels sluggishly in Pratchett's Discworld compared to our own.

One of the options proposed was that we could hang a lampshade over the sun, to direct the light. It's imperfect because of scattering and the lampshade would have to be made out of some sort of black hole material, but it would explain why you can't see the sun when it is swung away from you. It's no longer pointing at you, and the lampshade is in the way.

Appealing as having [a literal lampshade](#), we settled on an even simpler solution than that: we simply needed a thick layer of attenuating clouds over everything.

My captive physicist was skeptical that I could just blanket the world in eternal fog for the sake of solving our maths but I laughed and pointed out that it was very much in the genre of the gothic. Having a sun that was blood red in the distance from cloud refraction would also be excellent for thematic creepiness.

The decision to have a flat plane has other knock on effects. There is, for example, this Reddit post on [Where is the Horizon and What Does The Horizon Look Like?](#) comes to mind, though the Physicist noted that this world probably isn't big enough for this weird gravitational effect to happen.

We started getting into weather and climate speculations, which are not really things one can make quantitative predictions about on the back of an envelope while in a coffee shop. However we can make some guesses from general principles. The pendulum sun is a source of heat and energy and that's going to lead to turbulence as the air is heated and cooled.

As you get further and further from the pendulum sun, the air, naturally, colder. Thus the prevailing winds of the world would blow on average away from where the sun was. Physicist supposed eventually, in he thought would be a throwaway absurdity, he didn't see why the air wouldn't just freeze.

However, I was really, really taken with this idea.

And so it was that at very edges of fairyland are mountains and seas of nitrogen and oxygen (called by their old names of azote and vital air in the novel). From there, it was a small step to having fairies manually mine and haul it back to the centre of the world.

Much of this scribbling didn't make it into the final book, but this did result in Mr Benjamin being an ex-miner of azote who has been put out of work by [the Lady of Iron](#).

In all, the whole exercise was more than worth the price of a coffee. I hope I've shown how even a very fantastical world can have scientific underpinnings, or at least, inspirations. Thinking about the world can produce not just interesting tidbits but also thematic texture. Mr Benjamin, gnome and supporting character in Under the Pendulum Sun, could have been a tin miner, but it is rather too real. It lacks fantasy.

Equally, on the opposite end, Mr Benjamin could mine names, digging past strata of meaning to extract precious nouns that allow the market to keep up with the constant discovery of new things by the people in Applied Ontology. This, on the other hand, can feel disconnected, making Mr. Benjamin a migrant from a different story.

It's a strange, strange thing to be mining frozen nitrogen under a black sky and then bringing it under a pendulum sun but it grows smoothly from the central conceit and is supported by the whole of the rest of the narrative. Arcadia is a model of a world, after all, like the great clocks that created the world in miniature. And like those great works, it occasionally goes sproing.

This is perfectly natural and nothing to worry about.