

# **ASTR1002: Planets and the Universe.**

## **Assignment 4: The Universe of Planet Ziggy**

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I believe that the planet Ziggy is indeed in the same universe as our Earth. The laws of physics appear at this stage of research to be the same as ours. The planet orbits around its star. The axis of rotation is itself parallel to the rotational plane of the solar system, however that is not too out of the ordinary, for Uranus rotates in this fashion. There is a fairly normal moon orbiting the planet and the background stars seem to behave in the same manner as in our solar system. I can find no basis at the moment, for the hypothesis that we are indeed in another universe and so it is going to be assumed that we are in the same one.

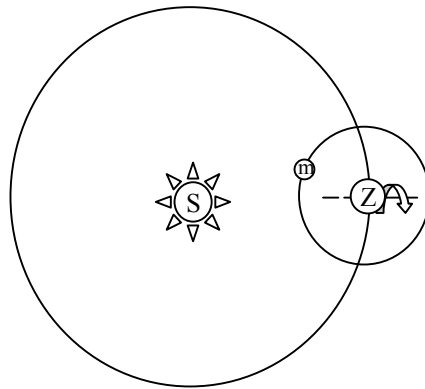
For the entire time that we have been marooned on the planet Ziggy, the sun has been hidden. We know that there is a sun and we are not just a rogue planet in space, because we saw it on the way down. It is a fairly normal G-type star and so should be bright enough to see in the sky, unless of course we are extremely far away. So we might assume that the rotational period of this planet is just extremely long and dawn has not yet come. However when we look into the sky we can see the moon and the stars all seeming to rotate anticlockwise around one star at the zenith. From the extent of the rotation per hour, you can see that the 'day' must be around 20-30 hours long. From this we can conclude that the planet is indeed rotating, however in an abnormal fashion. If the axis of rotation was perpendicular to the rotational plane of the solar system, then we should've seen at least four 'days' so far. Because we have not then I propose that Ziggy is actually rotating on an axis that is *parallel* to the rotational plane of the solar system. However the moon is orbiting around Ziggy in the 'normal' way, that is along the plane of the solar system.

This is supported by the apparent motion of the moon in the sky. It appears to spiral down from the zenith (or near to it) where it appears to be 'full'. As it spirals towards the horizon it becomes less 'full', the lit side always appearing to point to the horizon. This means that the pole of Ziggy that we have landed on is the one pointing away from the sun. Hence the side of the moon being lit is in the direction of the sun. The orbit of the moon and the rotation of Ziggy would cause the moon to appear to travel in this fashion. After 120 hours on Ziggy, the moon has moved from *almost* the zenith to 30° above the horizon. The distance between the zenith and the horizon is 90° and so the rotation of the moon (around Ziggy) in that time is 60°. However because it was not actually at the zenith, only *almost* then it was probably within 10° and so it moved between 50° and 60°. This means that the orbital period (360° rotation) of the moon is between 720 and 864 hours or 30 and 36 Earth days.

Because of the nature of Ziggy's interesting rotation and subsequent perpetual darkness only broken half the time by the moon, the surface of the planet would be quite cold, because of its lack of sunlight. Even though the moon is ten times brighter than ours, that is still not enough to warm the surface to habitable temperature. Since the surface does indeed seem to be habitable then it could be concluded that the planet Ziggy is indeed quite a bit closer to its sun than 1 AU for the dark side to be this warm. If this is the case then the near side to the sun must be extremely heated indeed.

The moon on Ziggy appears to be twice as large and 10 times as bright than Earth's moon. The surface also appears to be featureless. If the moon is the same size as the Earth's moon then it must either be twice as large or twice as close, most probably a combination of these two things. It appears so bright because Ziggy is much closer to

the sun than Earth is and according to the inverse square law (if the moon is not made of a more reflective substance) it is around three times closer. If the moon formed in the same fashion as Earth's did than that may explain the radical tilt of the planet. If a large (large enough to form a moon twice the size of Earth's) meteor hit Ziggy and caused enough debris to fly off and form a moon then that impact may have been powerful to knock Ziggy off it's axis. Especially considering that Ziggy is 23% less massive than the Earth.



**Figure 1.** The orbits of Ziggy around it's sun and the moon around Ziggy. The dotted line is the rotational axis if Ziggy. This simplified diagram is NOT to scale!