Stellar Metamorphosis: How Massive is GJ 3470 b's Atmosphere?

Jeffrey J. Wolynski
Jeffrey.wolynski@yahoo.com
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Rockledge, FL 32955

Abstract: Using the dead star mass limit of ~2.59 Earth masses, the total mass of GJ 3470's atmosphere should be ~11.14 Earth masses. This means the total mass of the atmosphere is probably >~81% of the total mass of the star. Explanation is provided.

The mass limit for a dead star is ~2.59 Earth masses, as is the mass of K2-259b, the densest and heaviest dead star observed to date.[1] Since there are no dead stars more massive or denser found yet out of the thousands of evolving stars found by Kepler and others, then it is reasonable to figure that the interior of GJ 3470b cannot be more massive. It is an active star that is still evolving, though probably a bit older and more evolved than both Neptune and Uranus. In any case, since the maximum mass of a dead star is ~2.59 Earth masses, the core (the forming planet) inside of GJ 3470b cannot be any more massive. This leads us to the simple calculation outlined in the abstract, though margins of error are not included, those are not important to show this idea. If you have an object that is gaseous and has a thick atmosphere, you can give an upper mass limit to the newly forming core (delineated by the newly forming interior crust). Since GJ 3470b is ~13.73 Earth masses, all you need to do is take that number and subtract 2.59 Earth masses (the dead star mass limit), to find the maximum mass of the newly forming core. That leaves us with ~11.14 Earth masses of atmosphere that will eventually be ablated away as it orbits its much hotter, younger, more massive host, which is in a much earlier stage of evolution.

To then determine what the mass percentage of the core is, with regards to the thick atmosphere, all you need to do is take 11.14/13.73, which is ~81%. The total mass of the atmosphere is therefore >81% the total mass of the newly forming rocky/iron core. You can do the same with 1 Earth mass. That would make 12.73/13.73 which works out to >92.7% of the total mass of the object. This is very, very interesting. If only we had a time machine that could take us to the future, we would see this object's atmosphere being ablated away by the host, eventually increasing in density until it reaches close to the dead star density/mass limit.

To show why this is important, it is necessary to show what University researchers at the University of Tokyo have said, "Fukui commented, "Suppose the atmosphere consists of hydrogen and helium, the mass of the atmosphere would be 5–20% of the total mass of the planet.""[2] This is very different from our observations though.

Saying the thick atmosphere will be ablated away, and then saying it is only composed of 5-20% of the total mass, is essentially saying we should find evolved stars (exoplanets) that are rocky and metal with extraordinary masses that are not yet observed! That being said, the researcher is essentially saying the prediction based on their modelling is that we should find rocky worlds with almost no atmospheres at ~11-13 Earth masses. Yet the largest rocky/metal object we have found to date is ~2.59 Earth masses. So with ~4,000+ exoplanets (evolving stars) found, no rocky, dense ones are more massive than 2.59 Earth masses.

Keep in mind the prediction that rocky/metal objects ~11-13 Earth masses would be found was made in 2013. Six years later we haven't even come close. Objects that size are still gaseous, which is predicted by stellar metamorphosis. The objects are planet ovens, as the planet is forming in the interior an extremely thick atmosphere is needed to prevent heat loss. What better way to form a planet, than to provide a method to prevent heat loss over extremely long periods of time, we're talking hundreds of millions of years. That method is an extremely thick hydrogen/helium atmosphere, which no doubt, have extremely high thermal heat capacities. Gas giants are planet incubators, or wombs if you will, huge blankets protecting the new baby planet in its interior, and providing nutrients as the planet grows internally. This is of course after the nebula stage, where the gas giant was very young, bigger and vastly hotter, too hot to form a core. It is suggested that the University of Tokyo step up their game too, not just the Americans.

References

[1] http://vixra.org/pdf/1906.0572v2.pdf
[2] https://arxiv.org/pdf/1302.7257.pdf