The Mass Independence and Dependence Principles of Stellar Formation and Evolution

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Abstract: In the recent paper, "KELT-17b: A Hot-Jupiter Transiting an A-Star in a Misaligned Orbit Detected with Doppler Tomography", it is referenced that, "a sample of well characterized planets around massive stars is necessary to understand the mass-dependence of planet properties." Two principles are provided to explain that mass-dependence attributed to formation processes is moot. Explanation is provided.

On page 2, the paper states, "a sample of well characterized planets around massive stars is necessary to understand the mass-dependence of planet properties." What they mean is that they think massive stars form at the same time as their companions in protoplanetary disks, and depending on how massive the objects are which orbit their hosts they will be able to somehow explain how they formed. The problem is that their assumption directly contradicts the coherency principle of stellar evolution,

> *"When a star is born its remains are incoherent particles that cannot form anything of significant size, as stellar birthing is too violent to allow for the classical mode of planet formation in a protoplanetary disk."*

A birthing star does not leave significant remains after it is born according to the coherency principle. This means the mass of the companion is not determined by the mass of the host in any fashion and cannot be explained with any mechanism which tries to connect the two. Therefore the mass independence principle of stellar formation can be stated quite clearly,

> *"The masses of stars are independent of each other when they are first formed/born."*

The only time that the masses of stars will become even partially dependent on their hosts, is if they are orbiting at a somewhat close distance, and their atmospheres and material are being ripped away by the hotter hosts. This means the mass-dependence principle can be written as,

> *"The mass of a star is partially dependent on its host during its evolution if the orbital parameters can cause mass loss of the companion."*

This all means that characterizing older evolved stars (KELT-14b) around massive, young A-type stars (KELT-14) by their mass will not lead to any understanding of their formation. This is because in the KELT-14 system the A-type star is very young, and the Hot Jupiter which orbits as its companion is very, very old and is having its atmosphere ripped away. Eventually it will expose its rocky/ocean covered differentiated core left over to continue orbiting it. They will co-evolve indefinitely according to the principle of stellar co-evolution and the young A-star will move down the line of its evolution as well, becoming cooler and smaller, losing mass and possibly allowing for its companion to host life on its surface.