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Leiden

The Netherlands

## **Turtles all the way down: multiscale simulations connecting star and planet formation**

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### **Citation**

Wilhelm, M. J. C. (2024, February 15). *Turtles all the way down: multiscale simulations connecting star and planet formation*. Retrieved from <https://hdl.handle.net/1887/3717680>

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Propositions  
accompanying the thesis

# Turtles all the way down

- Multiscale simulations connecting star and planet formation -

1. In low radiation environments, the lifetime of protoplanetary disks is dominated by external processes for M dwarf host stars and by internal processes for more massive host stars (*Chapter 2*).
2. The fragmentation of a stellar wind-blown shell into segments of different density can explain multiple components of shells around young clusters (*Chapter 3*).
3. Cluster gas left over from star formation shields protoplanetary disks from the radiation of nearby massive stars, enough to increase disk lifetimes but not enough to prevent the radiation from affecting planet formation (*Chapters 4&5*).
4. The computational efficiency of multiscale, multiphysics models can be improved by using more flexible temporal coupling (*Chapter 6*).
5. The proplyd and shell lifetime problems in the Orion Nebula can be solved if the region's most massive star is the result of a recent stellar merger (*Chapter 7*).
6. The influence of a star's birth environment must be taken into account when considering planet formation.
7. Research software has grown large and complex enough that its development and maintenance should no longer be solely up to researchers on temporary contracts.
8. Finding the simplest methods and initial conditions that allow one to answer their research question is one of the most important challenges of computational research.
9. Setting up and running a numerical simulation is a useful scientific exercise in itself.
10. The societal relevance of astronomical research is in communicating to the general public the sense of the universe's scale, and humanity's place in it, that is acquired through this research.
11. The optimal number of side projects is finite and non-zero.
12. The existence of this proposition proves that coffee is not required to finish a PhD thesis.

Maite Wilhelm  
Leiden, February 2024