Jennifer Larson

BS in Physics and Mathematics from Purdue University (2015) and PhD in physics from the University of Central Florida (pending)

What have you been doing since the publication of your article in JPUR, volume 5?

After graduating in spring 2015, I chose to gain more experience researching while working with Dr. Agee in the Earth, Atmospheric, and Planetary Sciences Department at Purdue. This experience helped me improve my research skills and become more independent as a researcher. The skills I gained during this year helped me significantly when I started graduate school at the University of Central Florida (UCF) in the fall of 2016. I am still working toward my PhD in planetary science at UCF and hope to graduate in a couple years.

What are your career goals?

After graduating from UCF, I hope to join a research lab at either a university or research facility. I really enjoy coming up with new ideas that can shape the way we view the universe. I plan to continue researching small body dynamics and creating models of how the solar system formed.

How did the research you did as an undergraduate at Purdue impact your current endeavors? What is the value of undergraduate research?

I strongly believe that undergraduate research is crucial to all careers in some form. As a researcher, students will be on the forefront of innovation and have the opportunity to share ideas with the world that no one else has ever thought. This training as an undergraduate prepared me to think critically and work through the scientific process on my own. Undergraduate research provided me with a safe environment where I could make mistakes and learn from my errors. Through these experiences I developed the skills necessary to have a successful career as a researcher.

GROWTH OF PLANETARY EMBRYOS

Student Author

Jennifer Larson is a 2015 graduate of the Purdue University College of Science. She majored in physics and mathematics with a minor in Spanish. Larson has been working with Dr. David Minton in the Earth, Atmospheric, and Planetary Sciences Department since her freshman year at Purdue. In this lab, Larson studied the formation of planets and assisted a graduate student to update a code to simulate cratering on the moon.

Mentors

David Minton's research interests include understanding the origin and early evolution of the solar system, including the formation of the planets and the Late Heavy Bombardment. Minton also studies the physics and dynamics of small bodies and their satellites, as well as using the impact records of solar system bodies to understand the history of small body populations.

Andrew Hesselbrock received his BS and MS in physics at Miami University. During his studies, he developed computational models to study the rotational dynamics of Nereid, a satellite of Neptune, which resulted in two publications. Hesselbrock entered the physics department at Purdue University in 2012 and is currently developing a disk model to simulate the formation of the Martian satellites.

Abstract

In order to fine-tune our current understanding of the formation of planets, we update the classic model of oligarchic growth to include mass conservation. In the early stages of planet formation, the protoplanetary disk contained only a swarm of planetesimals, rocky bodies with diameters of at most about 100 km, that collided together to form embryos greater than 1,000 km in diameter. Because planetesimals accrete, or accumulate, onto embryos, the surface mass density of the planetesimal swarm decreases with time. Here we describe surface mass density of the planetesimal swarm as the total initial surface mass density of the protoplanetary disk minus the surface mass density of the embryos. However, as the mass of the individual embryos increases, the average spacing between them must also change. Therefore, the parameter that is related to the characteristic spacing between embryos, *b*, must also change. We incorporate the changing eccentricity and surface mass density into a model that describes the growth of any given planetary embryo in the protoplanetary disk, which includes the new formulation for mass conservation. Finally, we test how the presence of a circum-embryo debris disk affects the growth rate of a planet. Because a debris disk in orbit about an embryo will increase the collisional cross-section of the planetary embryo, the time needed to fully grow the embryo decreases. The accelerated growth rate due to the circum-embryo disk holds implications for describing the formation of gas giant cores within the necessary timescale to capture the gas from the surrounding protoplanetary disk.

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Keywords

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How did the faculty mentor relationship impact you during your time at Purdue?

My faculty mentor, Dr. Dave Minton, guided me throughout my time at Purdue. He made sure that I had the right resources and assistance along the way. Dr. Minton did not hold my hand the entire time, but rather he guided me while letting me explore my project on my own. This type of relationship was very important to me as it allowed me to grow and explore my role as a researcher with guidance and a safety net.

How did the experience of publishing an article in JPUR benefit you? What advice would you give to other undergraduates at Purdue who are interested in contributing to the journal?

Publishing with JPUR was a perfect stepping-stone on my way to publishing peer reviewed articles. Through JPUR I learned about the process of publishing and the style of writing required for academic papers. For undergraduates interested in publishing a paper before graduation, JPUR is a great place to put your work. The review process is much simpler than the big academic journals, doesn't require large printing fees, and you will still be able

to put this publication on your CV for future schools and/or employers to see.

What advice would you give to other undergraduates at Purdue who are interested in doing research?

Try a bunch of different research experiences as an undergraduate. It will help you narrow down what you really have a passion for and give you a broad foundation for after you leave Purdue. This is especially important if you are considering graduate school after graduation. Graduate school is challenging, so it is essential to be incredibly passionate about your research projects. Purdue is a safe environment in which to experiment and discover what type of research speaks to you the most. Take advantage of this and try out as much as possible while you have the opportunity!

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