National Center
for Earth and Space Science Education
Universities Space Research Association

USRA

Visiting Researcher Profile

JOURNEY through the UNIVERSE

Dr. Joshua E. Colwell

Planetary Scientist
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Research Specialty: Small Bodies of the Universe

Bio

After 22 years at the University of Colorado where I obtained a Ph.D. In Astrophysical, Planetary, and Atmospheric Sciences, I am now on the faculty at the University of Central Florida. I'm a planetary scientist who studies just about everything in the solar system except the planets. Lots of unexpected things happen with the small stuff in our solar system. Comets smash into moons and break them into countless pieces, while giant planets can both capture dust and spit dust out into interplanetary space. Trying to understand the behavior of these leftover building blocks of the solar system has lead to several unique opportunities. As a planetary ring scientist for the Cassini mission to Saturn, I have run experiments on the space shuttle, and flown on NASA's infamous "vomit comet" airplane. (It's a great way to perform experiments in weightlessness and also a great way to make yourself sick.) Saturn's rings are a beautiful laboratory to study how the planets formed, and Cassini is returning stunning data of the ringed planet. I study the collisions in the solar system, both fast and slow—the former even got me a part in the movie "Deep Impact." While the slow collisions are less dramatic than the impacts that make craters on the Moon and wiped out the dinosaurs, the very gentle collisions may tell us a lot about how the planets formed. So in a way I do study the planets when they were in the process of being born from a cloud of dust and gas. Maybe that makes me a prenatal planetary scientist.

I have talked to over 4000 students, teachers, and family members as part of Journey Through the Universe. One of my main goals in talking to students of all ages is to demystify science in general and astronomy in particular.

Examples of Classroom Presentations

Mysteries of Planetary Rings **[Grades: 5-12]**
Saturn's rings are perhaps the most recognizable feature in the solar system. Hundreds of thousands of kilometers across, they are less than 100 meters thick and composed of countless chunks of ice from dust to city-sized moonlets. Jupiter, Uranus, and Neptune are also circled by planetary rings, and each ring system has its own peculiarities. Common to all of them, though, is change that is very fast, at least on astronomical time scales. While the planets are more than four billion years old, the rings show features that are far younger. What produced the rings? Were they produced by breaking up small moons, or perhaps a giant comet that wandered too close to Saturn? Are they somehow leftover from the birth of the planets and deceptively young? What will they look like a million years from now? These spectacular and beautiful disks of rock and ice have waves like the ripples in a pond and in some ways resemble the disk in which the planets themselves formed. After exploring the ring systems and what we think makes them work, we will explore the rings of Saturn with the spectacular images and data returned by NASA's Cassini spacecraft.

Gravity Makes the World Go 'Round **[Grades: K-12]**
We all have everyday experience with gravity, and it can be a real drag. But it's also what keeps the Earth moving around the Sun and the Moon moving around the Earth and what holds the Earth together, as well as holding us to its surface. However, things can get pretty strange when gravity is weak, such as in the early days of our solar system when there were no big planets. I'll talk about what weight and "weightlessness" are with examples from spaceflights and zero-g airplanes and how experiments in weightlessness are helping us understand the origin of the planets.

Building Planets, or Why the Solar System is the Way It is **[Grades: 5-12]**
After the Sun, our solar system is dominated by nine planets, and one of those, Jupiter, is more massive than all the others combined. Yet among those larger worlds are countless smaller objects we know as asteroids and comets that hold vital clues to the story of how the planets formed. Pictures from powerful telescopes are now giving us tantalizing glimpses of what our solar system must have looked like four and a half billion years ago: a vast cloud of gas and dust circling an immature star. The story of putting together the planets is a race against time and explains why Jupiter is more than 300 times more massive than the Earth, why Venus has no moon, and why Earth's lone moon is so large. It is a story of microscopic particles slowly sticking together, and planet-sized bodies crashing into each other in cosmic catastrophes, and it is a story that may play out around stars throughout our galaxy. I will show how a few simple ideas can explain many of the features of the solar system and talk about some of the mysteries still awaiting answers.

Examples of Family/Public Program Presentations

Exploring Our Solar System
While more than 100 planets have been discovered orbiting other stars in our galaxy, we're still learning a lot about our immediate neighbors. An intrepid fleet of robot explorers has shown us the scorching plains of Venus and the frozen moons of Jupiter and beyond. By learning about these worlds we learn about the history of our own world and its possible future as well. We will explore the solar system with a focus on Mars and what we have learned from the two rovers exploring that planet, and on Saturn and its family of moons and rings being explored by the Cassini spacecraft.