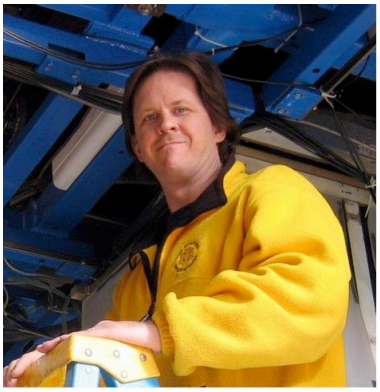
National Center
for Earth and Space Science Education

Universities Space Research Association

USRA

Visiting Researcher Profile

JOURNEY through the UNIVERSE



Dr. Timothy A. Livengood

Senior Space Science Researcher
National Center for Earth and Space Science Education

Research Specialty: Planetary Atmospheres

Bio

Dr. Tim Livengood is an observational planetary astrophysicist, studying the composition, temperature, and dynamics (wind) in the atmosphere of other planets in our solar system, using telescopes here on Earth and in space. Tim started life in Indianapolis, Indiana, attended Towson Senior High School in Towson, Maryland, obtained his Bachelor of Arts degree in Physics at Washington University in St. Louis, and received a doctorate in Physics and Astronomy from The Johns Hopkins University in Baltimore in 1991. Tim's doctoral thesis was a study of ultraviolet light from Jupiter's aurora using the IUE orbiting observatory. Tim still explores Jupiter's aurora, using light from all across the spectrum. Tim held a National Research Council post-doctoral appointment at NASA's Goddard Space Flight Center (GSFC), from 1991 through 1994, studying the atmosphere of planets and the July, 1994 impacts of the fragments of Comet Shoemaker-Levy 9 with Jupiter. From 1994 through 1999, Tim was a member of the Research Faculty at the University of Maryland, College Park. Since 1999, Tim has been engaged in science education and public outreach, pursuing astronomical research combined with communicating scientific discovery to the public. Tim has delivered science presentations to public audiences of more than 25,000 students and adults in groups of 30 to 1700, led educator workshops for over 1000 K–13 educators, and developed science education units in education modules for grades K–13. In addition to his main pursuits in scientific research and education, Tim also performs occasionally as a professional storyteller and has been known to tell stories as a way to illustrate central truths from the world of science and exploration.

Examples of Classroom Presentations

There's No Place Like Home–or is there? **[Grades: K-12]**

Earth is an excellent place for us to live. But is it the only place for anything to live? The exploration of the solar system has looked at the prospects for life elsewhere. Our first guess is that life of any kind needs resources and an environment similar to the Earth. But what exactly are the

Earth's resources for life? Is there anyplace else in the solar system that has some or all of the same resources? And now that humanity has begun to discover worlds outside our solar system—is there anyplace else in the universe that's like our home?

Invasion of the Robots from Earth! **[Grades: K-6]**
Humanity has explored far beyond the reaches of the Earth, nearly as far as the edge of interstellar space (and we're getting closer every day). We have visited every planet in the solar system, except for Pluto; many of them we have visited more than once. Yet, no human being has traveled out of Earth orbit in almost 30 years, and no human being has ever gone farther than the Earth's moon, the nearest world beside our own. So how did we visit those other places? With robots!

It's not easy being green. (Earth science focus) **[Grades: K-9]**
The Earth is our home and, so far as we can tell, it is the home of everything else that is alive. Let's think about how to describe this splendid planet we call home and then compare it to the other places in our neighborhood.

***It's not easy being green*.** (Astrobiology focus) **[Grades: 6-9]**
The Earth is our home and, so far as we can tell, it is the home of everything else that is alive. What is it that makes the Earth so uniquely suited to have life, and is it truly unique? To understand the answer to that, we need to understand just what it is that life needs to survive, and look to see whether it can be found elsewhere, in odd places here on Earth and maybe on other worlds.

What's up there? **[Grades: K-12]**
What's within one meter of the ground? Bushes, grass, small children, oceans, nervous little dogs, and many other things. What's within two meters of the ground? The same stuff, plus almost every human being on earth and most animals. What's within four meters of the ground? Add trees, houses, and elephants. Keep on doubling the height, and pretty soon you're off the Earth and halfway to the Moon. And if you've already gotten half-way to the Moon, why not double one more time and go all the way? Why not keep doubling and see what else is up there?

Aloha Mars **[Grades: 9-12]**
Most of humanity's exploration of the universe happens right here on Earth. One of the best places on Earth to see and to explore space is the top of Mauna Kea, an extinct volcano in the middle of the Big Island of Hawaii. I went to Hawaii to see something weird about the planet Mars: a natural laser that was there long before the human invention of the laser, or the Earthly invention of humans.

Examples of Family/Public Program Presentations

The ABC's of Comets
The last years of the 20th century gave us a nice crop of naked-eye comets—brilliant pinwheels to decorate the night sky. Not only are comets beautiful, they also are frozen leftovers of the early solar system, recording what was here and what it was like when the Sun and the planets formed. A comet or asteroid probably killed the dinosaurs, but long before that, comets may well have been the source of the water and gases that now are the air and the oceans and that make possible life, forests, you and me, and whatever you ate for lunch. Just for you, we'll gather all the ingredients for a comet and whip up a special recipe of comet-on-a-stick!

How Big is Big?
Looking up to a starry sky at night, it's hard to shake the feeling that the universe is big — and that we're not. That's not quite true, however. Every one of us is a part of that big universe, and so every one of us has a little bit of bigness, too. In this talk, we'll explore the length and the breadth of the

universe and take its measure. The universe is big, all right, but human imagination is big enough for the universe to fit inside.

The Ultimate Long Distance Call

Humanity has been calling out to the stars for nearly a century now, even though that is not what we intended. Radio and television signals, both the good shows and the bad ones, have been spreading out from Earth at the speed of light, saying "Hi! We're here!" to the galaxy. Radio telescopes on Earth scan the skies, spending part of their time looking for signals like our own. Maybe someday they'll tune into radio and TV shows from another world. It would be very exciting to find out that someone else is out there, but maybe it could go beyond that. What if they actually want to tell us something about themselves? In order to understand the message, we would need to have a language in common—and fortunately, we do! The language we share is the language of physics, chemistry, and mathematics. We will take a look at the potential for intelligent life in the cosmos, and the art of communication—even with others of our own species.

An Expedition to the Top of the World

From the summit of Mauna Kea, the highest peak in the Pacific Ocean, the Earth spreads out below your feet. The clouds are a mile below. The stars are thickly dust a limitless black sky. The faint hum of machinery comes to your ears. Some of the largest telescopes on Earth peer into the sky, seeking the secrets of worlds beyond our own. This is the core of astronomy, the quest to capture the faintest scraps of light from the mysterious universe that we are graced to inhabit. Come along on an expedition to explore the other worlds in our neighborhood. It's a hoot!