

**DANIEL J. EPSTEIN DEPARTMENT OF  
INDUSTRIAL AND SYSTEMS ENGINEERING**

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**EPSTEIN INSTITUTE SEMINAR • ISE 651 SEMINAR**

***Space Colonies Now! via Commerce,  
Robotics, and Systems Engineering.***

**Philip T. Metzger, Ph.D.**

**Lead Research Physicist and Founder of the Granular Mechanics and  
Regolith Operations (GMRO) Lab, part of the Surface Systems  
Swamp Works  
NASA Kennedy Space Center**

**ABSTRACT**

A revolution is now underway as humanity transitions from being a single planet species to a solar system species. This has been set in motion by the explosion of technologies over the 40 years since the early Moon landings of the Apollo program. Some of the key technology areas include: rocketry, robotics, additive manufacturing, chemical processing, solar power, and artificial intelligence, to name just a few. Unlike prior migrations of humanity across the continents and oceans of Earth, the first wave of space migration will be done through robotic telepresence because we are going to places that are hostile to our bodies. The continents here on Earth had been transformed before our arrival by life's activity across billions of years, converting the barren rocks and sunlight into topsoil with vibrant ecospheres where we can live. The new generation of space telepioneers, on the other hand, will have to do that job themselves. They will do it through robotic space mining, chemical processing, and in-space manufacturing, setting up autonomous industries and converting the barren rocks and sunlight into vibrant environments where we can live. The basic technologies to do this already exist, and telepioneering the incomprehensibly vast resources of our solar system holds so much economic potential that it can be a surprisingly short time before the first biological colonists actually live beyond Earth. You might see it in your lifetime. However, the complexity of the engineering systems required to transform the solar system so quickly will require the most advanced application of systems engineering humans have ever known. The growing list of commercial space companies whose business plan it is to do this profitably is a good indicator that the time is now!

**TUESDAY, JANUARY 22, 2013  
ANDRUS GERONTOLOGY BLDG (GER) ROOM 309  
3:30 – 5:00 PM**

## **SPEAKER BIO**

Philip T. Metzger, Ph.D. works at NASA's Kennedy Space Center as the lead research physicist and founder of the Granular Mechanics and Regolith Operations (GMRO) Lab, part of the Surface Systems Swamp Works. He has worked in the space program since 1985. He was a part of the Space Shuttle launch team and later with the International Space Station Program testing and assembling spaceflight hardware. For the past 10 years, he has performed research and technology development for solar system exploration (Moon, Mars, asteroids, etc.), focusing on mining and utilizing resources in space.

He earned a B.S.E. (electrical engineering) from Auburn University in 1985, a M.S. in physics from the University of Central Florida in 2000, and a Ph.D. in physics from the University of Central Florida in 2005. His doctoral work focused on the theoretical statistical mechanics of granular materials with applications to the mechanics of lunar and planetary soils.

Dr. Metzger was selected as the NASA Kennedy Space Center Scientist/Engineer of the Year in 2012 and was given the Silver Snoopy award by the NASA astronauts in 2011.