Pushing the Limits

Sara Seager’s search for life on distant planets is expanding our understanding of the known universe, and driving innovations in satellite technology.

Looking up at the sky on a clear, dark night, there are too many stars to count. And now, thanks to the ever-expanding body of research generated by astrophysicists and planetary scientists, like MIT’s Sara Seager, we are learning that there may also be too many planets to count, in orbit around those distant suns. Thousands of exoplanets have been identified in the last two decades, with the rate of discovery accelerating every year.

Our sun is just one of hundreds of billions of stars bound together by gravity in the Milky Way, which is only one of the hundreds of billions of galaxies in the observable universe. Given the vast realm of possibility, we cannot help but wonder: How many planets like Earth might be out there? Do any of those other Earths harbor life, perhaps looking out at the stars in their sky wondering the same thing?

With joint appointments to both the Department of Earth, Atmospheric and Planetary Sciences (EAPS) and the Department of Physics, Professor Seager’s research goal is to identify Earth-like planets and search for signs of life. Her team focuses on computational models and interpretation of data from Hubble and other space-based and ground-based telescopes to observe exoplanet atmospheres. Characterizing such atmospheres is key to understanding a planet’s ability to host life and even infer the presence of life. Dozens of exoplanets have been observed and studied to identify gases and derive atmospheric structure. But the exoplanet atmospheres observed so far are those of hot or giant planets—small, temperate planets of the type that might harbor life are not accessible by current telescopes.
To expand our view of the stars, Professor Seager and her team are working on pioneering space telescope projects to discover rocky worlds in the habitable zones of their host stars. With PI George Ricker from MIT’s Kavli Institute for Astrophysics and Space Research, she is a Co-Investigator of the MIT-led NASA TESS (Transiting Exoplanet Survey Satellite) mission—launching in 2017 to conduct an all-sky survey, imaging hundreds of thousands of nearby stars. TESS will cover 400 times more of the sky than any previous space telescope, identifying potential targets for further study by the James Webb Space Telescope, due to launch in 2018.

In addition to TESS, Professor Seager’s space instrumentation group is developing ASTERIA (Arcsecond Space Telescope Enabling Research in Astrophysics) in collaboration with NASA’s Jet Propulsion Laboratory and Draper Labs. This tiny 6U CubeSat prototype, also launching in 2017, could lead to a fleet of inexpensive mini-telescopes, each capable of monitoring a single, bright, sun-like star for two years.

Seager’s tenacious dedication to her goal of finding “another Earth” within her lifetime has also captured the imagination of the public—which finds her delivering TED talks, testifying before the U.S. House Science Committee, and garnering recognition from publications like the 2011 Nature “Top Ten,” and the 2012 Time Magazine “25 Most Influential in Space.” Beyond media attention, she has been recognized by her peers with numerous honors, including election to National Academy of Sciences in 2015, the prestigious Sackler Prize in Physical Sciences in 2012, and a MacArthur Fellowship in 2013.

About the Department
EAPS at MIT encompasses nearly every aspect of the natural world—from the inaccessible depths of the Earth’s interior to the far reaches of the galaxy. We investigate fundamental questions, such as the origins of life and the possibility of life on other planets, and advance our understanding of problems with profound societal implications, such as climate change, the prediction and mitigation of natural hazards, and the sustainable use of the Earth’s resources.

How You Can Help
For our work to continue, we need you. As federal funding for science shrinks, EAPS relies on generous gifts from our alumni and friends to ensure we continue to attract the most outstanding students and scientists in the field. There are a number of ways you can participate, such as supporting a graduate student or donating to our Discretionary Fund. Better yet, establish your own fellowship and create a lasting legacy at MIT.