``The Search for Life in the Universe''

Piecing together recent results from physics, astronomy, geology, chemistry and biology, we can start formulating a scientific answer to perhaps the most important unanswered scientific question: "Are We Alone?" – is life an accidental rarity, or is the Universe teeming with an abundance and wild variety of [intelligent] life forms, separated from each other by the vast space between their home planets? Carbon isotope evidence points to an early start for life on Earth, and our genes still contain the blueprint of what that early life looked like and what environments it thrived in. The mineralogy of Mars reveals the surprisingly Earth-like past of the red planet, and spectacular observations of water geysers on some of the moons of Jupiter and Saturn show that their interiors may represent very similar environments as well. Chemical analyses of carbonaceous chondrites and laboratory experiments on cosmic ice analogues furthermore show tantalizing connections between life on Earth and complex organics in space, and astronomical infrared observations indicate that the molecular building blocks for life are widespread and abundant in the Universe. The development of sensitive techniques to detect and study planets around other stars has revolutionized our understanding of exoplanets. Using transit, Doppler and spectroscopic observations, we can measure planet sizes, determine their composition, see their atmospheres, and search for biomarker signatures. We now know that there are billions of planets that have a decent chance to harbor life. Increased odds for life implies better chances to also find intelligent life. Several independent initiatives are currently transforming the Search for Extra-Terrestrial Intelligence (SETI) from a small-scale radio search to a multi-faceted enterprise that will provide firm quantitative limits to the number of communicating civilizations in the galaxy in less than two decades.