

43rd SYMPOSIUM ON THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE (SETI) – The
Next Steps (A4)
SETI 1: SETI Science and Technology (1)

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EXOPLANET DISCOVERIES AND THE FERMI PARADOX

Abstract

Frank Drake examined the probability of extraterrestrial intelligence by developing his famous equation in the 1960s, which stated that the number of intelligence species in the galaxy is the product of 7 factors, from the rate of star formation through the probabilities of planets, habitability, life arising, communicating civilizations developing, and their expected lifetimes. Drake concluded that the number of intelligent species in the galaxy was on the order of one thousand to 100 thousand, with the nearest being perhaps 1000 light years away. With Drake's numbers, it appeared that we should hear from the extraterrestrials rather soon; but after half a century of watching and listening, we have no evidence of them. The recent astronomical evidence for thousands of planets in other solar systems enhances the paradox between the increasing number of potentially habitable planets in the Galaxy and the lack of any evidence of extraterrestrial civilizations. This prompts a new look at several potential answers to the paradox, covering some aspects not often addressed by space scientists and SETI researchers. These answers involve space science, life science and social science. The astronomical probability of habitable planets is reviewed, emphasizing the potential rarity of Earth-like planets, and the orbital wandering of "hot Jupiters." The probability of the evolution of complex life is surveyed from a biological standpoint, from unicellular organisms to more complex life forms. The likelihood of the survival of intelligent species is reviewed from a physical anthropology standpoint, including past instances of near-extinction of the human species. The competition between societies as a driver for space exploration and development is discussed, along with the expected lifetime of civilizations based on Earth experience. Finally, all these factors are combined into a new look at the Drake Equation to develop a revised estimate of the number of intelligent species in the galaxy.