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PRACTICAL VON NEUMANN MACHINES AND THE FERMI PARADOX

Abstract

Von Neumann Machines are self-replicating robots. They have been proposed as tools for space exploration and interstellar communication. Some scholars within the Search for Extraterrestrial Intelligence (SETI) believe that an advanced alien civilization could deploy a fleet of Von Neumann machines to search for other intelligent lifeforms in distant star systems. In theory, Von Neumann machines could easily disperse throughout the galaxy over an extended period, making the possibility of detecting such a device fairly high. Our failure to discover a Von Neumann machine in nearby space poses an apparent contradiction to this theory, invoking one channel of debate within the Fermi Paradox. Scholarly discourse on interstellar Von Neumann machines generally ignores the complex technical challenges posed by their design, construction and operation. It is clear that designing a Von Neumann machine is well beyond present-day technology, but little attention has been given to their overall engineering. A general examination of the design requirements of Von Neumann machines exposes major scientific challenges to their operation. This supports the suggestion that interstellar Von Neumann machines could be impractical. In turn, this could explain our failure to discover extraterrestrial Von Neumann machines and dispel their potential relevance to the Fermi Paradox. One alternative to a classical Von Neumann machine fleet is the development of a robot “factory fleet” that manufactures space probes from a centralized production node then disperses them to nearby star systems.