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LONG DURATION GENESIS-TYPE MISSIONS TO EXOSOLAR PLANETS

Abstract

Time is arguably the key limiting factor for interstellar exploration. At high speeds, flyby missions to nearby stars by laser propelled wafersats taking a minimum of 50-100 years would be feasible. Directed energy launch systems could accelerate on the other hand also crafts weighting several tons, albeit only to cruising speeds of the order of 1000 km/s (c/300). It has been pointed out, furthermore, that superconducting magnetic sails would provide enough drag to decelerate interstellar probes cruising at velocities of 1000 km/s, passively, that is by transferring the kinetic energy of the craft to the interstellar protons. Given enough time, interstellar missions able to decelerate on arrival are hence feasible. There is presently however no cause for interstellar exploration with data return times of several millennia.

An alternative perspective is provided by missions aiming to offer terrestrial life new evolutionary pathways on potentially habitable but hitherto barren exoplanets. Time is not a limiting factor for Genesis type missions, that is when the task is to establish ecospheres of unicellular organisms on an extrasolar planet. These organisms could be carried either as germs, or synthesized in situ by a miniaturized onboard gen laboratory. The resulting biosphere would be in comparison to earth's history in a precambriam state, having skipped about three billion years of evolution. Subsequent autonomous development could give rise to higher life forms.

Genesis missions raise important ethical aspects, in particular with regard to planetary protection. Exoplanets come in all sizes, kinds, and degrees of habitability. It is to be seen to which level of confidence we will be able to determine from earth if a given exoplanet harbors life, if life is bacterial or advanced, or whether the planet in question is potentially but in fact only transiently habitable. The issues discussed involve both ethical and selected technical issues of Genesis missions, together with the prospect of finding suitable target planets. We find that active interstellar missions are potentially feasible.