Extraction of Antiparticles Concentrated in Planetary Magnetic Fields

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Small quantities of antimatter have enormous potential in a variety of space, medical, and sensing applications. However, such systems have not yet been realized due to the inherent limitations associated with current antimatter production and storage techniques. The present method of extracting sub-atomic collision debris from high energy particle accelerators is prohibitively expensive and generates only minimal quantities of antiprotons. In comparison, high energy cosmic rays bombard the upper atmosphere and material in the interstellar medium to copiously produce antiparticles naturally. We propose to extend our Phase I study to address the realistic feasibility of natural antiparticle 'mining' for space applications.

As described in our Phase 1 report, a fraction of the naturally generated antiprotons are concentrated around planets with magnetic fields. These antiparticles can be captured and stored in a man-made mini-magnetosphere surrounding a spacecraft and used to fuel an extremely high energy propulsion system, potentially enabling very fast missions to deep space (one year to Jupiter, and similarly fast trips beyond the heliopause [100+ AU] and beyond). While the initial study showed that antiparticles are a naturally occurring space phenomena in quantities sufficient to be of interest, the primary focus of our proposed twoyear study will be to do a detailed quantitative assessment of the mass of particles that could be collected, create comprehensive models of harvest systems, and conduct laboratory experiments to demonstrate these systems. The primary outputs of the study will include resolving the question of whether the natural supply is sufficient to justify development of mining tools, and will create a set of requirements and specifications for the design of the collection and storage device. In addition, we will develop a roadmap laying out key technology advancements that will be required to enable this capability, as well as a timeline for achieving those advancements.