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Antimatter Driven Sail for Deep Space Missions

Space is vast. Over the next few decades, humanity will strive to send probes farther and farther into space to establish long baselines for interferometry, to visit the Kuiper Belt, to identify the heliopause, or to map the Oort cloud. In order to solve many of the mysteries of the universe or to explore the solar system and beyond, one single technology must be developed – high performance propulsion. In essence, future missions to deep space will require specific impulses greater than 20,000 seconds in order to accomplish the mission within the career lifetime of an individual. Only two technologies available to mankind offer such performance – fusion and antimatter. Fusion has proven unattainable despite forty years of research and billions of dollars. Antimatter, alternatively, reacts 100% of the time in a well described manner. Development of a suitable propulsion system, however, based on antimatter has yet to be shown.

We propose to develop such a system. We will design a very straightforward system that will produce a variable specific-impulse with a maximum of near one million seconds. The concept is one that can be throttled, that can be steered, and that can be demonstrated within the next two years. We will identify the components of the system architecture that will be needed to perform a mission to the Kuiper Belt. In Phase I, we will also design a series of three experiments that will validate the concept and can be completed in Phase II using the Low Energy Antiproton Production facility.

