

SPACE PROPULSION SYMPOSIUM (C4)  
New Missions Enabled by New Propulsion Technology and Systems (6)Author: Mr. Sagar Satpathy  
SRM University, Chennai, India, sagar.satpathy@gmail.comMs. ANKITA SAHU  
United College of Engineering and Research, India, India, ankita.starinfinity@gmail.com

## APPLICATION OF ANTIMATTER AS FUEL FOR FUTURE SPACE MISSIONS

**Abstract**

To make inter-planetary and interstellar travel possible, We Need Futuristic and advanced propulsion mechanisms. Antimatter gives us the scope to fulfill our aspirations of Space Travel. What makes Antimatter a promising Fuel source is its unplumbed energy density. Its the most efficient fuel source known to physics. The annihilation of subatomic particles with their antimatter counterparts has the highest energy per unit mass of any reaction known in physics. Positronium are very much potential in this aspect. It consists of an electron and a positron orbiting each other. A gram of positronium would be able to propel a spacecraft upto interstellar distances, provided storage tanks can be made which can keep it in stable state. Storage facility need to be highly developed to keep the electron and positron away successfully suspending them using electromagnetic means. This paper focuses on a design, based on how to use this stored propellant i.e. positronium as a source of energy. It's known that Annihilation releases enormous energy which is nearly 300 times more than nuclear fusion reaction at the sun's core. If we can successfully shuttle the propellant and allow annihilation of matter-antimatter then our problem for future space missions will be solved. The annihilation will produce gamma rays and mesons which can be directed through a Superconducting magnetic nozzle to generate Thrust. To protect the space craft from these enormous  $\gamma$  Rays, we would be using effective Radiation shielding technology. Alternatively, Liquid Hydrogen or Xenon will be used as the matter and similarly the antimatter will be the positronium. It is very promising yet very far away from mankind. Antimatter doesn't exist in significant amount in nature at least or in our solar system. CERN and Fermi labs are doing constant R&D on significant production of Anti-matter. If produced then it would be used in rocket. The matter-antimatter annihilation will give scope to make interstellar travel possible. Its another aspect is speed, with antimatter propulsion system we can reach to nearly 99% speed of light which will further reduce the travel time by Einstein's time dilation theory. It uses less fuel as compared to the conventional chemical propellants and helps in travelling longer distances in less period of time. Less quantity of antimatter can provide and generate more Thrust in an efficient manner. This paper gives us brief idea of alternate uses of antimatter with different matters and materials for propelling a spacecraft in Future.