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ENHANCING IONIC THRUST GENERATION VIA NUCLEAR POWER

Abstract

As humans continue to venture into the depths of space, orthodox rocket engines are proving to be insufficient for the sheer ranges and speeds required; fortunately, there have been concepts which could prove to solve the same, and pave the way to a new era of interstellar travel. Ionic propulsion stands out as cutting edge technology, with its ability to drive spacecraft farther, faster and more efficiently than any other existing propulsion technology. In contrast to traditional chemical rocket systems, ionic propulsion systems have a considerably higher specific impulse and can generate high amounts of thrust with limited fuel consumption, over a large period of time. The "time" factor is what poses a problem with most ionic propulsion engines. They produce far too little initial thrust, and cannot be used widely for short range missions. To help set-up ionic propulsion systems for relatively shorter trajectories, a considerably higher initial thrust output is needed, and subsequently, a system which can provide extremely high energies to propagate ionization. This is where nuclear power steps in; harnessing the power of atoms themselves, the building blocks of matter, to fuel an already bizarre propulsion system, looks like something out of a science fiction movie; however as engineers, we turn science fiction into reality. This paper showcases how nuclear power can be effectively utilized to act as a power source for ion generation; focusing on a preliminary design of such a propulsion system, complete with a comparison of different fuel and electrode compositions to reevaluate engine efficiencies. Conventionally, Xenon is the fuel, however results determined from Krypton and Iodine have also been shown. Thrust vectoring is a fundamental method of significantly increasing the overall thrust generated, and certain thrust vectoring mechanisms have been covered in the scope of this paper. The results are sustained through simulations performed on software packages including Ansys Workbench, IBSimu and Fluka. The results presented in this paper have the potential to spark ambitious research endeavors and expand the boundaries of space exploration.