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THE CASE STUDY OF ADVANCED NUCLEAR PROPULSION METHODS FOR INTERSTELLAR UNMANNED PROBE TO ALPHA CENTAURI

Abstract

One of the biggest dynamos of mankind has been space and stars since the dawn of time. Mankind has looked upon the stars with awe since the dawn of civilization and with the idea of "Le rêve des étoiles" or "The Dream of Stars". Especially after the advent of the space age with the launch of Sputnik in 1957, a new era has started for humanity. Now with the advances in science and technology, even though we are still limited to solar flights, the potential for interstellar flight has become a real possibility. In addition, the travel of Voyager 2 to interstellar space in recent years has become mankind's first interstellar flight. Due to the long distances involved, using chemical propulsion is precluded as a possibility and more advanced forms of propulsion methods have to be considered. While ion propulsion and solar sails remain a significant contender, due to their inherent limitations, nuclear propulsion still remains as the most probable method for interstellar travel. However, from the Tsiolkovsky equation, its inherent that interstellar travel requires high specific impulse and nuclear propulsion provides the means for the highest specific impulse in the existing technologies. This paper focuses on the most feasible form of nuclear propulsion methods such as fusion pulse propulsion and gaseous core fission propulsion with Uranium Hexafluoride as a fuel, since both options give a better specific impulse as compared to classic nuclear methods. After describing both concepts, there will be a case study of an interstellar flight from a High Earth Orbit to Alpha Centauri system will be discussed with specific calculations for both methods to compare their feasibilities and requirements. These calculations and comparisons can be used as a stepping-stone for further research for more far interstellar destinations such as the Barnard's Star or Lalande 21185.