Paper ID: 60951
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IAF SPACE PROPULSION SYMPOSIUM (C4)
Joint Session on Advanced and Nuclear Power and Propulsion Systems (10-C3.5)

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# ADVANCED NUCLEAR PROPULSION METHODS FOR DEEP SPACE MISSIONS

**Abstract**

'Le Reve d'Etoiles' or the Dream of Stars has been a common dynamo for mankind since the dawn of the civilization. Since mankind has looked upon the stars, he has felt the compulsion to reach out there. However, mostly this has remained a dream rather than a reality due to limitations in current space technology. When it comes to manned missions, the farthest location that we have been able to reach is the Moon. Going to a nearby planet such as Mars with a manned mission still seems to be at least a decade away with the present technology. In addition, transportation of unmanned probes for deep space missions also has not really advanced too much as compared to the technologies of the Voyager missions' era. Current technology allows for decades to pass before it can even be possible to reach heliopause with a new probe. However, regardless of these above conditions, it is essential to explore options for deep space missions as well as interstellar missions. Consequently, in the present, the dream of stars compels many scientists to work on deep space missions to outer solar system and even beyond the heliopause as well as interstellar missions, even though it may not be possible to initiate such a mission with current technology. This paper discusses the possibility of using advanced nuclear propulsion methods such as gaseous core nuclear systems, supercritical helium reactors as well as advanced fusion propulsion systems. Their advantages as well as challenges are examined in this paper and several case studies are provided to help the reader to understand their feasibility. While many other propulsion systems such as antimatter drive and ion drive research continues, it is the belief of the authors that nuclear systems still have competitive edge over other propulsion systems for deep space mission in terms of technical and financial feasibility.