Brief Words on U.S. Fusion Research

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1. Comments about the status of U.S. research

In the intention the contribute, even in a simple way, in the effort of NAS Committee for a Strategic Plan for U.S. Burning Plasma Research and Fusion Energy Division at American Nuclear Society (FED-ANS), we would like to expose some few comments.

We begin summarizing some aspects of the magnetic fusion research in the U.S.A. with the list of some institutions and that research to enumerate a few, clear, without forgenting that exist many important institutions doing frontiers fusion and plasma research in the U.S. The Magnetic Fusion Energy is conducting with studies in some devices as on Advanced Divertor Experiment (ADX) at MIT[1] in which various regimes of interest for future reactors are explored in a device conceived as a compact, high-magnetic field, high-power density tokamak, and that allow implementation of various innovations. Alcator C-Mod tokamak also at MIT is another device that allows research in a compact, high-magnetic-field, diverted tokamak which allows experiments important for world fusion program [1]. At Princeton, there is the research on National Spherical Torus Experiment Upgrade (NSTX-U) in which the innovative configuration of tokamak spherical allow studies with plasmas of higher plasma pressure for a given magnetic field strength [2]. We also can cite the Fusion Technology Institute at U. W. – Madison in which the researchers work in the development of many fusion concepts as tokamaks, spherical tori, stellarators, tandem mirrors and others [3]. Important to mention that the US ITER is a DOE Office of Science project hosted by Oak Ridge National Laboratory in Tennessee with partner labs are Princeton Plasma Physics Laboratory and Savannah River National Laboratory [4].

A important nuclear fusion research realized in the U.S. is related to materials. As instance, we can cite the studies about interactions between hot plasma and wall are realized at MIT as 1) exposing a material wall to an energetic plasma, 2) removing of plasma fusion fuel implanted and trapped in the wall, 3) analyse of thermal and mechanical properties changed due action of neutrons produced by fusion, 4) study of nano-scale surface structures exposed to certain plasma conditions. In this group also there is research on high-energy-density physics and astrophysics research [1].

An important research that need be mentioned is the works of University of Washington on Z-pinch stability [5] and works related with the potential of electric power generation by using X-rays and gamma rays for direct energy conversion in fusion reactors [6], very promising works.

In the US and in the world, new companies with aim of developing innovative fusion devices make part of the search for the ultimate energy. In the U.S., we can talk TAE Technologies [7] are developing the field reversed configuration (FRC) reactor, which if its system works, it is a promise to nuclear fusion propulsion in the future according to some authors. The company

which is studying this concept already has taken significant steps toward the engineering integration of the FRC technology and has operated this national lab-scale machine, which in many aspects resembles a future power plant.

When we speak about the futurist theme of fusion energy, or better in nuclear fusion propulsion research, we cannot forget the existence in the US of the non-profit corporation (section 501(c)(3) of the Internal Revenue Code) Icarus Interstellar [8]. This non-profit corporation realizes theoretical studies related to the application of nuclear fusion energy as propulsion for space travel by engineers, physicists and others scientists of many nations in a volunteer work. In this area, also is important to consider the research related to the University of Texas Austin on Variable Specific Impulse Magnetoplasma Rocket (VASIMR) project [9].

2. Consideration of the Future in relation to the U.S. is or not a partner in ITER

ITER is an adventure of great proportions and unique in types of innovation that are generating in its development and construction. Certainly, one-day nuclear fusion energy will be a safety, an affordable and a sustainable energy source in the world. The U.S.A., as a country that already understands, recognized and enjoys the benefits of all types of many innovations, cannot do Its future without ITER.

Certainly, a nation cannot spend its resources in all directions. Recognize the best choices is a great challenge that can produce many revenues or many outlays. Therefore, we believe that the U.S.A. should continue as a partner in ITER due its particularities of being a challenge of great scale with countless innovations and benefits, even more, to be a true way for endless energy.

3. References

[1] https://www.psfc.mit.edu/research, accessed Jan 20, 2018.

[2] http://www.pppl.gov/nstx, accessed Jan 21, 2018.

[3] http://fti.neep.wisc.edu/studies, accessed Jan 21, 2018.

[4] https://www.ornl.gov/content/us-iter, accessed Jan 21, 2108.

[5] http://ieeexplore.ieee.org/abstract/document/6817607/?reload=true, accessed Jan 21, 2018.

[6] http://www.tandfonline.com/doi/pdf/10.1080/18811248.2011.9711683, accessed Jan 21, 2018.

[7] https://tae.com/, accessed Jan 21, 2018.

[8] http://www.icarusinterstellar.org/, accessed Jan 21, 2018.

[9] http://adsabs.harvard.edu/abs/2009APS..PSF.E2005G, accessed Jan 21, 2018.

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