# Updates of SHAO Active H Maser and Design of the Space Principle Prototype

Jiayu Dai[1], Yong Cai[1], Xueling Hou[2], Tiexin Liu[1], Zhengkai Li[1], Di Zhuang[1], Wujiabei Xu[1,2], Haohui Que[1,2], Yueqiang Liu[1,2], Mingzhou Yu[1,3], Lei Yang[1,4]

[1]Time & Frequency Research Laboratory, Shanghai Astronomical Observatory, Chinese Academy of Sciences, Shanghai, China

[2]School of Materials Science and Engineering, Shanghai University, Shanghai, China

[3]School of Astronomy and Space Science, University of Chinese Academy of Sciences, Beijing, China

[4]Department of Physics, Shanghai University, Shanghai, China

Email: daijy@shao.ac.cn

**SHAO**(**Shanghai Astronomical Observatory**) is now researching a space active hydrogen maser(with the goal of 50kg below) for **Chinese Space Station** demands, by reducing to a large extent the volume and the mass of the current ground active maser(of more than 200kg). Therefore, the vacuum system has been re-designed footing on the compound of getters, employing a freshly developed alloy, with a miniature ion pump, from the point of view that it being excellent at performance and reliability besides a lightened weight. Speed and capacity of the hydrogen absorption were figured out by sample measurements and regarded as sufficient. Meanwhile, improvement of the magnetic sensitivity by the efforts done on particular material development will be delightful in the light of sample researching experiments, with an update permeability being more than double of our best current industrial permalloy. Microwave cavity as shown in Fig. 1, still working on TE011 mode, will not be changed much for ensuring its loaded quality factor being greater than 35,000, and its average temperature coefficient no more than (1kHz)/K, before some microwave ceramics[1] being proved valid, in the circumstance of the instability performance($\leq 1.5\times10^{-15}$@10,000s) being considered. In addition to developing materials and crafts for the compact space active maser, we are simultaneously studying the reliability of the maser operation, such as evaluations of the dissociator, analyses of the robustness of the design, comparison of the hexapole state selector with the quadrupole one, etc.. Parameters of our work and discussions on the upcoming principle prototype are presented.

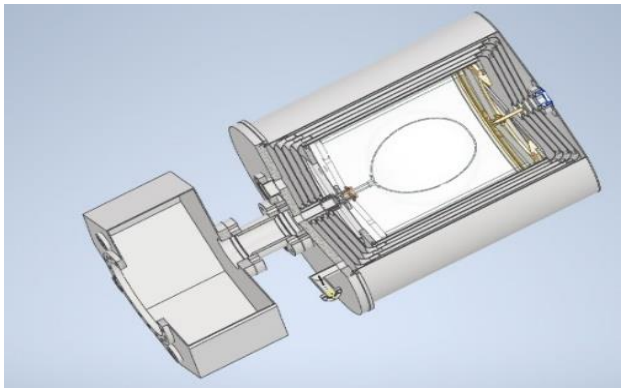

Fig. 1: Active H maser with the vacuum system partially re-designed used for microwave cavity and magnetic shielding system verification experiments.

[1] K. Matsumoto, T. Hiuga, K. Takada, H. Ichimura, "Ba (Mg1/3Ta2/3)O3 Ceramics with Ultra-Low Loss at Microwave Frequencies", Sixth IEEE International Symposium on Applications of Ferroelectrics, Bethlehem, PA, USA, 1986, pp. 118-121, doi: 10.1109/ISAF.1986.201108.