Mercury Trapped Ion Frequency Standard
For Space Applications

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Mercury trapped ion microwave frequency standards provide a number of advantages for
ground based applications requiring both very high stability and robust continuous
operation. Space applications also require low volume, power, mass, and insensitivity to a
highly variable external environment (e.g. temperature, magnetic, radiation). In addition
the standard must be able to withstand mechanical vibration and shock associated with
launch and orbit insertion maneuvers.

We will report on recent activities to develop a small, low power, and low mass mercury
trapped ion frequency standard flight demonstration model. The goal is provide 10 year
operational life and an order of magnitude improved stability over existing flight
standards at all averaging time intervals. The prototype design takes advantage of recent
advances including using a Nitrogen buffer gas for long vacuum pump life and a multi-
pole ion trap to minimize sensitivity to the second order Doppler shift [1,2]. The present
development effort, design, tradeoffs, and a number of recent laboratory results will be
presented.

« Nitrogen Buffer Gas Experiments in Mercury Trapped Ion Frequency Standards »,
2000 IEEE/EIA International Frequency Control Symposium and Exhibition, pp. 668-
671, Kansas City, MO June 7-9, 2000.

Linear Multipole Ion Trap », 2000 IEEE/EIA Int. Freq. Contr. Symp. , pp. 706-710,
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