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## II. Abstract:

### A. Paper Title

#### **Exploration of Anomalous Gravity Effects by rf-Pumped Magnetized High-T<sub>c</sub> Superconducting Oxides**

### **Statement of Problem:**

A number of anomalous gravitational effects have been reported in the scientific literature during recent years, but there has been no independent confirmation with regard to any of these claims. Therefore, the NASA Marshall Space Flight Center, in response to the propulsion challenges specified by NASA's Breakthrough Propulsion Physics (BPP) program, proposed to explore the possibility of observing anomalous gravitation behavior through the manipulation of Josephson junction effects in magnetized high-T<sub>c</sub> superconducting oxides. The technical goal was to critically test this revolutionary physical claim and provide a rigorous, independent, empirical confirmation (or refutation) of anomalous effects related to the manipulation of gravity by rf-pumped magnetized type-II superconductors. Because the current empirical evidence for gravity modification is anecdotal, our objective was to design, construct, and meticulously implement a discriminating experiment, which would put these observations on a more firm footing within the scientific community. Our approach is unique in that we advocate the construction of an extremely sensitive torsion balance with which to measure gravity modification effects by rf-pumped type-II superconductor test masses. This paper reviews the anecdotal evidence for anomalous gravity effects, describes the design and development of a simplified torsion balance experiment for empirically investigating these claims, and presents the results of preliminary experiments.

## Outline:

### I. Introduction

This section will briefly review the growing number of anomalous gravity effects which have appeared in the scientific literature. It will emphasize the central importance of magnetized high  $T_c$  superconductors to these reported anomalies and set the stage for an experiment aimed at exploration of these effects using a simple torsion balance.

*1. What is the immediate unknown, make-or-break issue, or curious effect under investigation, and how does it relate to the BPP Technical Challenges?*

*The effect under study is the reported observation of anomalous gravity reductions in the vicinity of magnetized high- $T_c$  superconductors.*

### II. Experimental Approach

This section will describe our experimental approach using a torsion balance including detailed design information, torsion balance design, superconductor material, steady magnetization circuit using permanent magnets, rf excitation circuit, cryostat design, high-fidelity sensors, instrumentation, sensitivity estimates, noise amplitude, experiment automation, etc. A comparative experiment methodology is described in which experiments without superconductor effects are compared with experiments with superconductor effects. Detailed statistical analysis procedures are described.

*2. What did you do to resolve this unknown, issue, or effect (methods, procedures)?*

Implemented a torsion balance to compare gravitational attraction with and without superconductor effects.

### III. Results

The results of the experiments, including detailed statistical analysis results will be presented. Emphasis will be placed on the quantitative aspects of the results. Any measured anomalous deviation from a null result will be presented in a skeptical light. No theoretical interpretation of such an effect will be attempted.

*3. What type of results will you be reporting (experimental data, theory, etc.)?*

The reported results will be experimental.

*4. What conclusion do you foresee having by the manuscript due date (May 18)?*

Only limited data will be available by manuscript due date. The authors intend to gather data right up to the conference date. The manuscript will be written just prior to the conference and will be hand-carried by the authors to the conference.

### IV. Conclusions and Recommendations

The conclusions and recommendations section will avoid sensationalism. Any deviation from currently accepted physics would be treated with skepticism. The authors will provide a thorough self-critique of the experimental program including likely

experimental defects which could generate erroneous data. If anomalous behavior is observed, the authors will encourage the development of duplicative efforts as a means of independent confirmation or refutation. The authors will emphasize that the details of their experiment, data analysis, and results are fully and completely available to the public.

5. What do you recommend as the next step?

Priority would be on independent confirmation experiments if warranted by the results. Null results would not necessarily rule out possible anomalous gravity effects by superconductors since we are examining a single experimental arrangement, only. Other physical arrangements may still be of interest.

6. SUMMARY/CONCLUSIONS SECTION (This is where I'm deviating slightly from the norm.) Plan to include in your manuscript a one-to-four paragraph description, in plain English, (adaptable for general public dissemination), that puts your increment of research progress in perspective and explains its relevance and importance.

The authors will provide this description as requested.