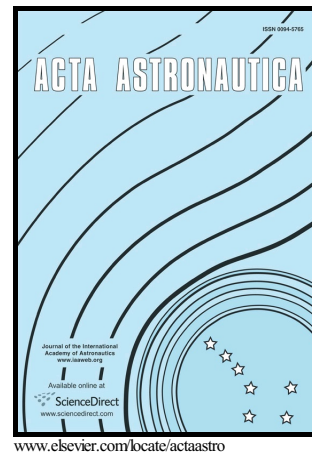


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Oleg G. Semyonov



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Diamagnetic Antimatter Storage

Oleg G. Semyonov

State University of New York at Stony Brook, Electrical Engineering, Stony Brook 11794 USA

osemyon@gmail.com

Abstract

The prime candidate for fueling relativistic starships is antimatter and reaching the stars will require antimatter storage on board of a spacecraft in a compact form, most likely liquid or solid antihydrogen. The problem is how to store antimatter in a container made of conventional matter. The solution is an energy barrier on the inner surface of the tank wall preventing antimatter from contacting the wall. Diamagnetic antihydrogen can be kept apart of conventional matter, if a gradient magnetic barrier is created near the inner surface of a tank. In this article, various magnetic barriers induced by arrays of current-carrying superconductive loops are studied by numerical simulations such as mosaics of rectangular loops, arrays of concentric circular loops (top and bottom of a cylindrical container), arrays of identical circular loops that form the cylinder element of the container, and arrays of loops distributed over sphere. The force acting on liquid and solid antihydrogen and the maximum height of antihydrogen ‘fuel’ in a tank are calculated. The problems and challenges caused by antihydrogen vapors are discussed.

Keywords: antimatter, diamagnetism, antihydrogen storage, magnetic barrier, relativistic rocket

1. Introduction

Relativistic interstellar rockets propelled directly by the products of matter-antimatter annihilation [1 – 5]) or powered by an annihilation reactor supplying electric power to a relativistic ion drive [6] cannot be realized without solving the problem of antimatter storage onboard – the ultimate energy density fuel which is our only hope for fueling the relativistic starships [6] and reaching the stars – and a significant amount of it stored in a compact form, most likely liquid or solid antihydrogen. A sort of container made of conventional matter should be constructed, otherwise it couldn’t be a part of the rocket’s hull or fixed

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