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Experimental Limits on Antigravity in Extended Supergravity

Stefano Bellucci

INFN-Laboratori Nazionali di Frascati, c.p. 13, 00044 Frascati (Roma)

and

Valerio Faraoni

Department of Physics and Astronomy, University of Victoria

P.O. Box 3055, Victoria, B.C. V8W 3P6 Canada

Abstract

We present a research communicated by Stefano Bellucci to Section 1 - high energy physics and elementary particles - of the LXXXII National Meeting of the Italian Physics Society, held September 1996 in Verona.

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A motivation for this research is lent from the LEAR experimental activity on the production of antimatter at CERN [1]. Building upon [2] we consider the constraints imposed by the presently available experiments, i.e. the observational data on the binary pulsar PSR 1913+16, high-precision tests of the equivalence principle and experiments searching for a fifth force, on the antigravity (gravivector and graviscalar) fields [3] predicted in the graviton-supermultiplet of extended supergravity with $N = 2, 8$ [4,3]. We prefer to focus on the latter well-defined and consistent theories, however there are more general phenomenological analysis about antigravity based on models containing free parameters [5]. We obtain very low upper bounds on the range of interactions mediated by the gravivector (1 meter) and graviscalar (100 meters) [6], which proves that these fields cannot play any significant role in non-relativistic astrophysics, for the weak-field limit of $N = 2, 8$ supergravity. Hence these antigravity fields can possibly be important only for processes involving the strong gravity regime, i.e. near black holes or in the early universe, when their Compton wavelength is comparable to the size of primordial structures.

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