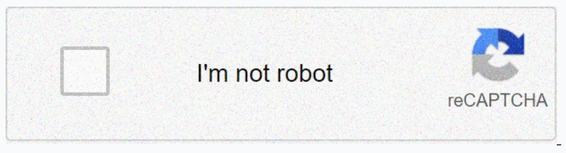

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The Wall of Fundamental Constants

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(Dated: November 2010)

We consider the signatures of a domain wall produced in the spontaneous symmetry breaking involving a dilaton-like scalar field coupled to electromagnetism. Domains on either side of the wall exhibit slight differences in their respective values of the fine-structure constant, α. If such a wall is present within our Hubble volume, absorption spectra at large redshifts may or may not provide a variation in α relative to the terrestrial value, depending on our relative position with respect to the wall. This wall could resolve the "contradiction" between claims of a variation of α based on Keck/Hires data and of the constancy of α based on VLT data. We derive the properties of the wall and the parameters of the underlying microscopic model required to reproduce the possible spatial variation of α. We discuss the constraints on the existence of the low-energy domain wall and describe its observational implications concerning the variation of the fundamental constants.

PACS numbers:

There are very few observations which can be directly and unambiguously related to new physics. The study of relative wavelength shifts in quasar absorption spectra at high redshift is indeed one of them as systematic achromatic shifts in these spectra can be attributed to changes in fundamental constants, and in particular in the fine-structure constant, α. This would most certainly call for physics beyond the standard model. Study of the variation of constants on cosmological scales is also the best way to test the equivalence principle on cosmological and astrophysical scales [1]. It opens a window on deviations from general relativity on scales where it is necessary to introduce dark energy and dark matter and on which we have very little constraint on the validity of general relativity [2].

Claims of a variation in α from observations of quasar absorption spectra using the many multiplet method [3] had sparked an enormous amount of theoretical activity in attempts to explain a temporal variation in the fine structure constant [4–8]. If confirmed, the Keck/Hires data which yielded a statistically significant trend indicating $\Delta\alpha/\alpha = (-0.54\pm0.12)\times10^{-5}$ over a redshift range $0.5 \lesssim z \lesssim 3.0$ (the minus sign indicates a smaller value of α in the past) could indeed point to new physics. However, subsequent studies based on VLT data using the same method have shown $\Delta\alpha$ to be consistent with zero [9, 10]. These results remain somewhat controversial [11].

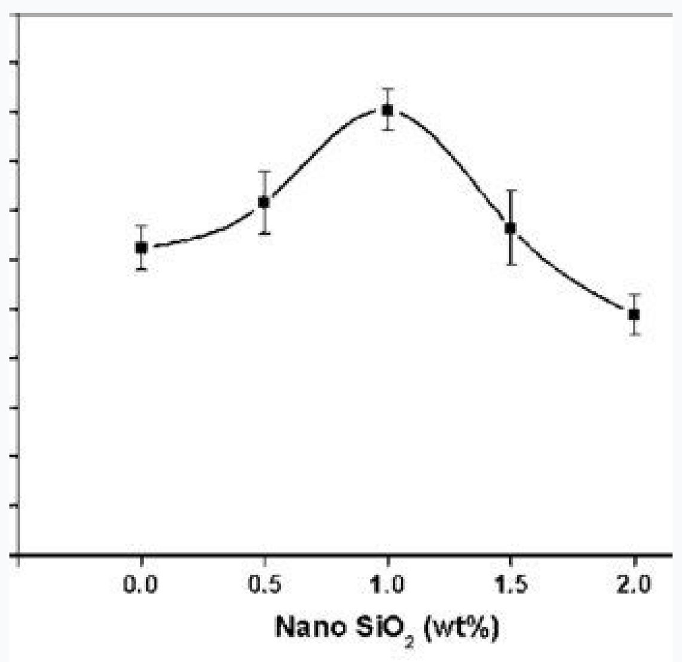
If the low energy constants of physics depend on some dynamical scalar field, ϕ, they become dynamical and may well be space-time dependent. On cosmological scales, it is usually thought that the time variation dominates over spatial fluctuations, as suggested by most models. The reasoning here is straightforward. For a scalar field coupled to electromagnetism, the Lagrangian contains a term $\frac{B_F(\phi)}{4}F_{\mu\nu}F^{\mu\nu}$, $F_{\mu\nu}$ being the Faraday tensor and B_F an arbitrary function of ϕ. This will necessarily induce a coupling to matter which is generated radiatively if not present at the tree level (see below). The equation of motion for the scalar field simply takes the form

$$\Box\phi + \frac{\partial V_{\rm eff}}{\partial\phi} = 0, \qquad (1)$$

where $V_{\rm eff}$ includes the self interactions of ϕ as well as any couplings to matter, so that it may depend on the local energy density of matter. For example, should the Lagrangian contain a term $B_N(\phi)m_N\bar{N}N$, then the coupling to matter is effectively density dependent, which could serve as the source of spatial variations through

$$\Box\phi + m_\phi^2\phi = B_N'(\phi)\rho_N, \qquad (2)$$

where m_ϕ is the scalar mass and ρ_N is the baryon en-



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New generations of rocket engines

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Abstract

The article, based on mathematical model of the space and particles revealed in "Theory of Space" (Sobolewski D. S., Theory of Space, 2016) (Sobolewski D. S., Theory of Space, 2017) and the description of the propagation of photons stated in publication entitled "Geometry of the Dark Matter and Preliminary Analysis of Alpha and Beta Photons' Properties Based on Theory of Space" (Sobolewski, Sobolewski i Sobolewski, 2017), describes transverse waves propagating in space, including gravitational, fluctuating and matter waves. In particular, it focuses on waves of matter in which orientation of the spatial channels, connecting four-dimensional boundary hypersurfaces ${}^{\beta}\aleph^{\beta}$ and ${}^{\alpha}\aleph^{\alpha}$, had been stabilised. For this type of the wave of matter the minimum energy value for deformation of boundary hypersurfaces of the matter waves $E_{f_{min}}(v)$ has been appointed, which is smaller by several orders of magnitude than energy needed to change the orientation of vertical disturbances of space which connect four-dimensional boundary hypersurfaces ${}^{\beta}\aleph^{\beta}$ and ${}^{\alpha}\aleph^{\alpha}$.

The obtained results were used to introduce a new classification of rocket engines and to provide examples of their implementation. Furthermore, the article demonstrates first attempts to construct a rocket engine of the new type, including description of the principle of operation of the engine, which is subject of patent application entitled "HTS Photonic Rocket Engine" (Poland Patent nr P.421517, 2017), as well as presents an example of spacecraft shell implementation, which enables stabilisation of orientation of its spatial channels. The Article thus reveals new perspectives for interplanetary travel through significant increase in spacecraft velocities, while simultaneously reducing the energy required to achieve them. In addition, the article describes interaction of photons ${}^{\beta}\gamma$ with the boundary hypersurface ${}^{\beta}\aleph^{\beta}$, while determining the change in photon frequency depending on its curvature $\frac{v}{v_0}(\kappa)$.

(All co-authors provided equal contribution to the creation of this publication.)

Keywords: Rocket Engines, Gravitational Waves, Matter Waves, Fluctuating Waves, Theory Of Space

Introduction

The results presented in this publication reveal the possibilities of constructing new generation rocket engines and spacecraft, which have been unknown until now, velocity of which can even reach relativistic magnitudes, which is astounding. They are a consequence of the scientific basis formulated in "Theory of Space" (Sobolewski D. S., Theory of Space, 2016) (Sobolewski D. S., Theory of Space, 2017), as well as in the publication which describes the properties of alpha and beta photons (Sobolewski, Sobolewski i Sobolewski, 2017).

The publication proves that the structure of space and the propagation of photons, as well as other elementary particles in it, are significant in the construction of new generation rocket engines. A good example of the application of such knowledge is the structure of HTS Photon Rocket Engine (Poland Patent nr P.421517, 2017), as well as the rocket HTS engine with stabilisation, which will be discussed in this publication.

Study of the physical and structural properties of CR-39 detector using Pu-239 alpha source

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Abstract

The physical , and structural properties of CR-39 detector polymer irradiated using alpha particles from Pu-239 source were studied by FTIR spectroscopy and chemical etching process. Samples of CR-39 detectors were irradiated with alpha particles at different energies (2.42, 3.05, 3.62 ,4.2 and 4.65 MeV) of Pu-239 alpha Source. The etching technique was used to clarify the tracks on CR-39 samples due to irradiation. The physical parameters of solid state nuclear track detector CR-39 such as; track etching rate, bulk etch rate, and detector sensitivity were investigated in this work, and the dependence of those physical parameters of CR-39 polymer detector on the alpha-particle energy were illustrated. The track density are growing with increasing of both alpha energy and fleunces. One of the important results obtained in this work is the gradual linear decrease of both the detector sensitivity and the alpha track diameter with increased alpha particle energy, which indicates that the CR-39 polymer detector can be used as an alpha-particle spectrometer. The FTIR spectrum reveals that there is an increase in the intensity of the characteristic peaks with increasing the irradiation fleunces.

Keywords: Pu-239, CR-39, Physical properties, FTIR spectroscopy, Alpha irradiation.

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(5) They emerge from the nuclei with tremendous speeds in the range of `(1)/(100)`th to `(1)/(10)`th of the speed of light in free space. While treating the cancer patient, doctors use a technique called Unsealed Source Radiotherapy. Now, let¢ÃÂÂs understand what alpha particles are.Alpha particles were named after the Greek alphabet ¢ÃÂÂÃ±Â¢ÃÂÂ. This technique involves inserting alpha particles like Radium-226 in tiny amounts into cancerous masses. As these particles are congruent to Helium nuclei. Some of its uses are:For Treating Cancer PatientsWe use alpha particles in cancer treatment. The symbol for the alpha particle is Ã±Â or Ã±ÂÃ²Â¢ÃÂºÂ. Text SolutionSolutionÃ Â:Ã ÂNature of `alpha`-particles
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