A SHORT NOTE ON ESTIMATING NUCLEAR BINDING ENERGY WITH QUANTUM CHROMODYNAMICS AND ELECTROWEAK INTERACTION

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ABSTRACT

Semi-empirical mass formulae are lagging in implementing quantum chromodynamics and electroweak interaction in understanding nuclear binding energy. In addition, they also fail in estimating absolute nuclear binding energy coefficients. In this context, considering Up and Down quarks and pions and weak bosons, we have presented a four-term nuclear binding energy relation with one common energy coefficient.

THE RELATIONSHIP OF DENSITY IN NOBLE GASES AND METALS WITH THE SIZES OF ATOMS AND THEIR NUCLEI

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ABSTRACT

The analysis of the relationship between the density of elements (noble gases, metals, and semimetals) with the parameters of atoms and their nuclei is carried out. It is shown that there is a clear correlation between the density and size of the nuclei of noble gases. In metals and semimetals, a weak correlation is seen between the densities and diameters of atoms. In this group, the relationship between the densities and diameters of atomic nuclei is more significant. A high correlation has been revealed between the densities and the ratio of the nuclei volumes to the atomic volumes.

TORSION GRAVITY

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ABSTRACT

Based on the discovery by astrophysicists of dark matter halos around galaxies, stars, and planets, it became possible to abandon the speculative concept of the spatial curvature of Einstein's space-time fabric and geometric gravity. Torsional gravity and spinors in fundamental theoretical physics should be based on a new cosmology, including a dark matter halo rotating with planets, stars, and galaxies and forming funnels in the continuous space environment of a quantum vacuum (dark matter). The article discusses the nature of tornadoes and tropical hurricanes.

THE "AWAKE" PROJECT AT "CERN" AND THE "T-15 MD TOKAMAK" IN SAROV (RUSSIA) IN THE LIGHT OF MAXWELL'S REAL ELECTRODYNAMICS

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ABSTRACT

The article raises the question of revising the classical Maxwell electrodynamics and abandoning the Lorentz calibration. The authors of the AWAKE projects and the device for thermonuclear fusion of the T-15 tokamak are guided in their calculations by Maxwell's classical electrodynamics, which differs from real electrodynamics. At the Kurchatov Institute, after 60 years of fruitless and very costly efforts, they realized the futility of further attempts to keep plasma at a temperature of millions of degrees using a closed magnetic trap and moved on to the implementation of a new hybrid tokamak T-15MD, in which at a much lower temperature implemented nuclear and thermonuclear energy.

MATHEMATICAL MODEL OF SYMMETRICAL DUPLEX CASCADE WITH INITIAL MATERIAL FEED TO AN ODD STAGE

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ABSTRACT

The problem of symmetrical cascade with the initial material feed to an even stage has been solved previously. Since even and odd stages in a duplex cascade differ, material feeding to an odd stage essentially affects the character of material distribution in the cascade stages. The main point is that it considerably affects the composition of separation products, i.e. represents another means of controlling the final product composition.

HIGH-STRENGTH PHOSPHOGYPSUM BINDERS

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ABSTRACT

The article presents the results of experimental studies aimed at developing a method for obtaining a high-strength phosphogypsum binder. For this purpose, it is proposed to neutralize impurities in phosphogypsum with lime, firing it at a temperature that ensures the production of β-$CaSO_4 \cdot 0.5H_2O$ and grinding with the introduction of a complex modifying additive into the binder composition, including Melflux – polycarboxylate superplasticizer and powdered slaked lime in the optimal ratio. Experimental-statistical models are presented that allow one to quantify the effect of technological factors on the strength of the modified phosphogypsum binder. With the use of X-ray phase and electron microscopic methods, the features of hardened microstructure were determined.

NANOCELLULOSES AND THEIR POTENTIAL APPLICATIONS

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ABSTRACT

Cellulose is the most abundant and renewable natural semicrystalline polysaccharide. This biopolymer has nanofibrillar architecture that promotes the release of free cellulose nanofibers (CNFs) and nanocrystals (CNCs). This review article describes the isolation methods, structural characteristics, properties, and potential applications of CNFs and CNCs. However, high production expenses hinder the wide application of these nanocelluloses. To reduce the production cost of CNFs, some pretreatments have been proposed. In addition, a waste-free technology of nanocrystalline cellulose can be used, which allows completely utilizing materials and chemicals to produce cheap nanocrystalline aggregates (NCA) with zero emission of liquid and solid waste. Due to the low expenses, such a nanostructured product, NCA, will be quite competitive with commercial microcrystalline and powdered celluloses, and therefore it can be served as filler and thickener. Various potential applications of nanocelluloses were also described.

STUDY AFFINITY OF POLYSACCHARIDES FOR WATER

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ABSTRACT

In this research, the structural characteristics, specific surface area, sorption of water vapor, and wetting enthalpy of various polysaccharides (cellulose, hemicelluloses, starch, pectin, chitin, and chitosan) has been studied. It was confirmed that crystallites are inaccessible to water, and therefore water molecules can interact only with polar groups in noncrystalline (amorphous) domains of biopolymers. The isotherms of water vapor sorption for various polysaccharides had a sigmoid shape, which is explained by the absorption of water molecules in heterogeneous amorphous domains having clusters with different packing densities. The method of contributions of polar groups to sorption of water molecules was used, which allowed to derivate a simple calculating equation to describe the shape of sorption isotherms. The wetting of biopolymers with water was accompanied by a high exothermic thermal effect, in direct proportion to the amorphicity degree. The sorption values and wetting enthalpies of amorphous domains of biopolymers were calculated, which allowed finding the water affinity index and comparing the hydrophilicity of the various polysaccharides.

DIAGNOSTIC OF A HUMAN TISSUE BY ALTERNATIVE ELECTRIC FIELD

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ABSTRACT

Method of a human tissue diagnostic by Alternative Electric Field (AEF) was developed. Properties of the tissue were characterized by time-dependent measurements of the resistance, the reactance (capacitance), and the phase shift. The measurement was done every five minutes for half an hour with the measurement time being one second or less. The properties were measured for the different amplitude of the applied voltage (0.3, 0.6, 1.0, and 1.5 V) and different frequencies (20, 100, 300, 600, 1000, 5000, 10000 Hz). It was found two statements of the tissue after the alternative voltage was applied the non-irritated and irritated. For the non-irritation state the tissue resistance, capacitance, and phase shift were constant values during six measurements. For the irritated state, the tissue response was immediate (fast – after the first measurement), the resistance jumps up and capacitance jumps down relatively non-irritated state. In the next five measurements, the resistance and capacitance were returned toward a non-irritated state and saturation showing an adaptation prosses. The irritated state depended on the applied voltage and the frequency. The dynamics of the tissue response was characterized by an irritation ratio. The irritation ratio increased for both applied voltage and frequency. These results manifested in response to the non-monotonic growth of the resistance irritation ratio (related to the electrolyte composition of the tissue) with the maximum at 300-600 Hz and monotonic growth of the capacitance irritation ratio (related to the tissue membrane operation). The irritation examined in the experiment was related mostly to irritation by the electric field and negligible thermal aspect as a result of the electric power absorption.