

ФИЗИКО-МАТЕМАТИЧЕСКИЕ НАУКИ

THE DISCOVERY OF SPIN SHOCK WAVES OF OPTICAL RANGE.

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Summary: Spin shock waves are relativistic plasma waves of a special type propagating with the speed of light with an electromagnetic spin flip on the wave front. There are spin shock waves of X-ray range, space gamma-ray range and a range of Decimetric waves. Here we show following to the macroscopic approach that the laser wakefield phenomenon applied for laser plasma accelerators nothing but how to spin shock waves of optical range. In another side spin shock waves of space gamma-ray range accompanied by the new electro-gravity spin density wave production.

Аннотация: Спиновые ударные волны – это релятивистские плазменные волны особого типа, распространяющиеся со скоростью света с перевертыванием электромагнитного спина на фронте волны. Известны спиновые ударные волны рентгеновского диапазона, диапазона космических гамма-лучей и диапазона дециметровых волн. Здесь мы покажем, следуя макроскопическому подходу, что лазерное wakefield явление, применяемое в лазерных плазменных ускорителях, не что иное как спиновые ударные волны оптического диапазона. С другой стороны спиновые ударные волны диапазона космических гамма-лучей сопровождаются выходом новых электро-гравитационных волн спиновой плотности.

Key words: laser-driven acceleration, waves oscillations, and instabilities in plasmas and intense beams, laser-plasma acceleration of electrons and ions, spin shock-waves, gravity spin density wave.

Ключевые слова: лазерный механизм ускорения, волны и неустойчивости в плазме и мощных пучках, ускорение электронов и ионов лазерной плазмой, спиновые ударные волны, гравитационные волны спиновой плотности.

Statement of the problem. V. Malka [1] found that fundamental researches on superconductivity, even if some aspects are not yet fully understood, have conducted to the discovery of many applications such as 1) superconducting cavities that are now used in modern accelerators, which have been then successfully used to understand deeply the structure of matter and fundamental interactions. This “virtuous circle” also applied for Laser Plasma Accelerators (LPA). LPA required powerful laser systems able to deliver stable laser pulses in the few tens of TW to a few PW. In LPA, the extreme electric fields result from 2) the collective motion of electrons produced by the intense laser pulse. In the case of an underdense plasma, the ponderomotive force of the laser creates a density perturbations, that propagates with 3) a phase velocity close to the group velocity of the laser, that is closer to the speed of light. The density perturbation is called 4) relativistic plasma waves, and the related phenomena, the laser wakefield. Initially, proposed in 1979 to generate accelerating fields of order of GV/m in the linear regime (see [1]), the laser wakefield has moved on to a more successful non-linear regime that was explored and demonstrated in 2002 to the 5) bubble regime [2]. Spin shock waves are relativistic plasma waves of a special type propagating with the speed of light with an electromagnetic spin flip on the wave front. There are Spin Shock Waves (SSW) of X-ray range [3-4], space gamma-ray range [3-6], charge particles and ions accelerators [6-7] and a range of Decimetric waves [8].

Analysis of recent studies and publications. In another side the space rays generation mechanism on a method of direct transformation of intergalactic gamma-rays to the proton current on spin shock-waves ensure precise agreement between generated proton

currents (spin shock waves theory [9]) with the angular distribution data of Galactic gamma-rays as well as for the individual pulses of gamma-/X-ray bursts. There is a precise confirmation of the generated currents (theory [4, 9], also see [5]) with the burst radiation data characterized by the standard deviation of $\pm 1\%$ in intensity in relative units within the sensitivity of the equipment. Thus, it was found that the spin angular momentum conservation law (equation of dynamics of spin shock waves) in the X-ray/gamma ranges is fulfilled exactly in real time. The nature of gamma-bursts largely determined by the influence of powerful external sources. The angular distributions anisotropy Galactic gamma-rays and pulsars is determined by the paradoxes way, so this can only take place under conditions of the isotropy of space-time [3, 5].

Previously unresolved parts of the general problem. In another side spin shock waves of space gamma-ray range accompanied by the new electro-gravity spin density wave production. In an equivalent alternative approach to detect (LIGO) gravitational waves in presence of torsion was found [10] that there is an equivalence with GR. In [11-12] found an exact cosmological solution with Friedman’s asymptotic in the form of conformal flat Fock’s metrics at large times, describing the stage of decay on a cold dust-like medium of do not interacting among themselves particles and a light like isotropic radiation. In fact, the effect of communication electromagnetic vector-potential with the trace of a torsion in [13-14] at high times indeed, the process of enlarging the space-time in the model metrics Friedman conformal equivalent to Minkowski space with a gradient torsion trace in the CGTG Newtonian limit, accompanied by a polarization effect separation of electric charges by an induced electric field

\vec{E}^F , manifested in the formation of plasma-like medium with a zero complete electric charge, that in the later stages of evolution is identical to Fock's model of a cold dust-like medium of do not interacting among themselves particles moving here with the same speed as in point 2, 3 above.

The purpose of the article. Here we show following to the alternative macroscopic approach that the laser wakefield phenomenon applied for Laser Plasma Accelerators nothing but how to spin shock waves of optical range.

Methods and Results. There are two alternative approaches micro- and macroscopic. The first operated with the distribution function. A particles density is defined by the integral distribution function for speed. According to point 3 above in the LPA in the laser wakefield phenomenon the laser creates a density perturbation, that propagates with a phase velocity close to the group velocity of the laser, that is close to the speed of light. It was shown in this letter [1] how, with a single laser pulse, one can control the injection to produce a stable and tunable quasi-monoenergetic electron beam. So the speed of the electrons can be considered the same, and their distribution considered as Delta-shaped functions both in macroscopic approach. You can also consider fulfilled the condition for solvability theorems on kinematic spin shock waves [9], requiring that the wave front speed coincides with the speed of light. According to [1] the typical size of the cavity is about the plasma wavelength λ_{pe} , which scales with $n_e^{-1/2}$ and is about 10 microns for a plasma density of 10^{19} cm^{-3} . For a plasma density of 10^{11} cm^{-3} in SSW [8] the typical size of the cavity is about the observable plasma wavelength 10 cm. This is accompanied by abnormal plasma opacity. An electromagnetic spin flip theoretically must be accompanied by the emergence of further polarization of the scattered radiation. That and recorded [8]. Formation of the cavity itself following the analogy of point 1 above as superconducting cavities, that are now used in modern accelerators, now well established: in the limit of high temperature superconductivity task in D3 solved exactly [15], superconducting condensate on copper compounds is localized on the surface of the sphere radius 10 microns. Because of differing polarizations condensate and normal phase on the surface of superconducting cavities has place spin flip. Therefore the same occurs and to the cavity is about the plasma. Thus the fact of forming spin shock wave of optical range is selected.

Conclusions and suggestions. In alternative approach we based on the new exact results in the field of superconductivity. Formation of the cavity itself following the analogy of point 1 above as superconducting cavities, that are now used in modern accelerators, now well established: in the limit of high temperature superconductivity task in D3 solved exactly [15], superconducting condensate on copper compounds is localized on the surface of the sphere radius 10 microns. Because of differing polarizations condensate and normal phase on the surface of superconducting cavities has place spin flip. Therefore the same occurs and to the cavity is

about the plasma. Thus the fact of forming spin shock wave of optical range is selected.

In addition the new electro-gravity spin density wave energy production in the scattering length of 2 Fermi is equal to 100 MeV (muon mass) and in range of the proton Compton length: 2-3 MeV (deuteron binding energy).

Here we show following to the alternative macroscopic approach that the laser wakefield phenomenon applied for laser plasma accelerators nothing but how to spin shock waves of optical range.

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