

*Short Communication***Internuclear forces: Physical and chemical reasons****B. A. Mosienko**

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The arguments, obtained in favor of the hypothesis on internuclear interaction of atoms (offered by author in the preceding publication), are presented. It is proposed an interpretation of physical phenomenon Bragg peak, which is discovered 100 years ago but is not understood hitherto. An extremely simple and natural explanation of chemical covalent bond (which unlikely may be considered satisfactory at present) is produced.

Key words: Internuclear interaction, π^0 -mesons, Bragg peak, chemical bond.

INTRODUCTION

As is known, the psychological need to live in a comprehensible world is inherent in us primarily. "People are inclined to consider that they know everything that may be known. Such philosophy of life had always been. It is enough to read the works of Newton's contemporaries in order to see that in those times many people believed that with the discovery of classical laws of mechanics, our cognition of inanimate nature was completed" (Kapitsa, 1959). Nevertheless, our notion of surrounding world increases and sometimes essentially changes.

In the preceding works, Mosienko (2008, 2009) have propounded and grounded a notion of the new state of matter in atomic-molecular form, which is called second liquid. In order to solve the problem on the character of forces between second liquid molecules, author has proposed a hypothesis on the internuclear interaction of atoms (Mosienko, 2013). Note, that this hypothesis is not an arbitrary author's fantasy; it proceeds from a definite likeness between two levels of matter - nuclear and

molecular. Indeed, principal elements of the nuclear level are protons; principal elements of the molecular level are atoms. It is known, that radius of atom is about 10^5 times as much as radius of proton. The effective radius r of central forces is determined by mass m of their carriers:

$$r = h/mc, \quad (1)$$

where h is Plank constant and c is velocity of light. The carriers of forces between protons in atomic nuclei are π^0 -mesons. By analogy, it is naturally to suppose that the carriers of forces between the neighboring atoms of second liquid molecules are the light and electrically neutral analogs of π^0 -mesons that is, some x^0 -mesons (which are given off by protons) with mass, as it follows from Equation (1), about 10^5 times as less as mass of π^0 -meson.

Below it is shown that the proposed hypothesis allows to interpret the physical phenomenon Bragg peak and gives a new explanation of the chemical bonding.

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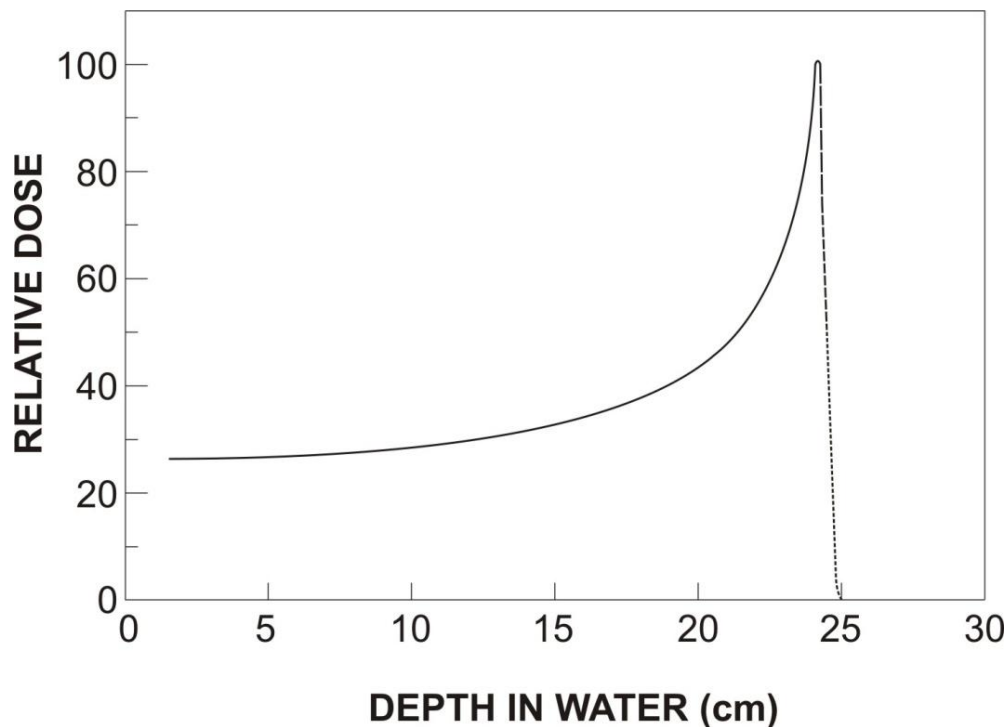


Figure 1. The ionization curve of a proton beam in water (Bragg peak).

THE PHYSICAL PHENOMENON BRAGG PEAK

Bragg peak (Wagenaar, 1995; Khoroshkov, 2006; Soltani-Nabipour et al., 2009) is a drastically expressed maximum in the end of the curve which represents radiation power dependence of the substance, through which a charged particle (for example, proton) moves, from kinetic energy of this particle (Figure 1). It had gotten its name from well-known English physicist Henry Bragg, who discovered this phenomenon in 1903. Note that Röntgen radiation is the radiation of substance observed in Bragg peak; in the course of some decades, it is employed for medical treatment of malignant formations.

At present, the origin of Bragg peak is explained as follows: the charged particle, in the end of its way, moves slower; so, the interaction cross section of it with substance, which it moves through, increases. Just this increase is observed in the form of peak. It is quite easy to understand that such explanation is unconvincing. Indeed, let us pay attention to the shape of Bragg curve. At first, it slowly rises, and this ascent really could be explained with an increase of the interaction cross section during a decrease of the charged particle velocity. But in the very end, Bragg curve suddenly rises and forms a sharp peak. Such form of the curve testifies that we deal with the resonance curve. But the origin of this resonance remains unknown. Otherwise, the physical essence of this phenomenon is incomprehensible

hitherto. Let us endeavor to explain this phenomenon. We know, that the irradiation of atomic nuclei with a bunch of the quickly moving protons (by proton's kinetic energy about 300 MeV) leads to the appearance of great number π^0 -mesons, which, at insignificant share of second, decay into gamma-quanta (Kitaigorodsky, 1973); by this, π^0 -meson turns into two gamma-quanta. Just the appearance of great number of gamma-quanta is observed in experiments. Process of gamma-quanta formation has resonance character; the real π^0 -meson forms from the virtual one by way of resonance absorption of the half proton kinetic energy (about 150 MeV), the second half of energy is taken away by collided particles.

In the case of Bragg peak, an analogous phenomenon is observed: when the proton kinetic energy is reduced approximately to 3000 eV, the sudden appearance of great number of Röntgen radiation quanta happens. This radiation also has resonance character. By analogy, we come to conclusion that, during resonance absorption of the half proton kinetic energy, the proposed virtual particle (x^0 -meson) turns into the real particle and at once decays to the couple of Röntgen photons. We emphasize that the real kinetic energy of protons, corresponding to Bragg peak, is unknown, it could be found just with a special experiment. The above mentioned value (3000 eV) is hypothetical (as $300 \text{ MeV}/10^5 = 3000 \text{ eV}$), but it is quite plausible. As we can see, the hypothesis on the internuclear interaction makes it possible to explain the

physical essence of Bragg peak phenomenon.

ON THE NATURE OF CHEMICAL BOND

It is clear enough that our hypothesis can explain not only a bonding between second liquid molecules, but also a chemical bond between atoms in molecules. This problem, in part, is considered in the author's preceding work (Mosienko, 2013); here we intend to continue this theme.

It is known that experimental values of ionic bond are noticeably higher than theoretical ones; this excess is named "nonionic contribution" (Barnard, 1965; Erdey-Gruz, 1967). In our opinion, this contribution is mainly indebted to internuclear interaction.

Let us proceed to covalent chemical bond; we consider a bonding of atoms in hydrogen molecule. The quantitative calculation of chemical bonding, for the first time, was fulfilled by German researches W. Heitler and F. London in 1927. Of course, the solution of this problem might be considered as scientific feat. But let us glance at this problem, as far as possible, unprejudicely. In order to initiate bonding between hydrogen atoms, electrons of atoms might be transferred (at any rate, partly) in the internuclear space. It is easy to see that in this case, Coulomb's law would be infringed. In addition, coordination of the electrons movement would be violated. Unnaturalness of such behavior of electrons is obvious. However, we must reconcile ourselves with such interpretation; otherwise, it is impossible to explain the existence of molecules in the frame of existent notions. In the meantime, if one will apply the hypothesis of internuclear interaction of atoms, the problem of covalent bond will be extremely solved in a simple and quite natural manner (Mosienko, 2013).

CONCLUSION

Thus, the resonance absorption of kinetic energy of protons is observed in the two points: about 300 MeV and about 3000 eV. In the first case, we *know* that transformation of virtual π^0 -mesons into the real ones

takes place. In the second case, we *propose*, by analogy, that transformation of virtual x^0 -mesons into the real ones happens. This enables interpretation of Bragg peak phenomenon, which may be considered an argument in favor of the proposed hypothesis. Further convincing argument, from personal perspective is the simplicity and naturalness of covalent bond in the new understanding. It should be emphasized that this hypothesis is propounded from necessity, for explanation of the interaction mechanism between second liquid molecules. The other important results (in particular, essential simplification of chemical bonding mechanism) are received automatically, that is, without supplementary suppositions. Apparently, it means that the proposed idea is something greater than pure hypothesis.

Conflict of Interest

The authors have not declared any conflict of interest.

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