academicJournals

Vol. 11(15), pp. 207-208, 16 August, 2016
DOI: 10.5897/IJPS2016.4493
Article Number: 4309BD760019
ISSN 1992 - 1950

http://www.academicjournals.org/IJPS

International Journal of Physical Sciences

Short Communication

The third fundamental interaction of atoms

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Received 12 April, 2016; Accepted 1 August, 2016

It is shown that the existence of fundamental interactions cannot explain the chemical covalent bond. The existence of a new (hitherto unknown) fundamental interaction of atoms-internuclear attraction, which adequately interprets the chemical covalent bonding was proposed.

Key words: Fundamental interaction, chemical covalent bonding, internuclear attraction.

INTRODUCTION

In this work, a discussion on the topic, which is dedicated to the preceding author's article (Mosienko, 2014), was continued. At present, four types of fundamental interactions are known: weak nuclear, strong nuclear, gravitational and electromagnetic interactions (Barnard, 1965; Swartz and Goldfarb, 1974). These interactions and how they influence our notions of the surrounding world should be considered.

Nuclear interactions (weak and strong) practically do not influence us: they take place inside atomic nuclei and are perceived just theoretically. Gravitational interaction holds all beings on the surface of the planet and allows free movement on it; it is known also, that the planets (including the Earth) rotate around the sun owing to gravitational field. Electromagnetic interaction, first of all, gives the possibility to see the surrounding world; besides, as is known, atoms are formed from the more elementary particles with the aid of electromagnetic field.

It is easy to understand, that the totality of these interactions is not complete: it does not include the notions of molecules consisting of the identical atoms. It is considered, that atoms of such molecules attract one another by means of the "exchange forces", which have electromagnetic nature (Heitler and London, 1927). In this work, different interpretation is proposed.

The physical nature of chemical covalent bonding

Let us fulfill a following mental experiment. Assume that two atoms of nitrogen are in contact and are immovable (Figure 1a). This is imaginary model, which might be realized only by the absolute temperature T=0. Of course, in this case, along the circular orbit of each atom with the radius R rotates only one electron, and on the orbit, is situated exactly one electron wave (electron is on the lower level of energy).

In the real model, atoms are moving, and electron shells are deformed by collisions. If the nuclei of atoms are brought together to the distance equal or smaller than atomic radius R, electrons can begin to move along the common orbit in the form of figure-of-eight, which embrace both nuclei of atoms (Figure 1b). Only so is the hydrogen molecule formed. As known, in this case, a

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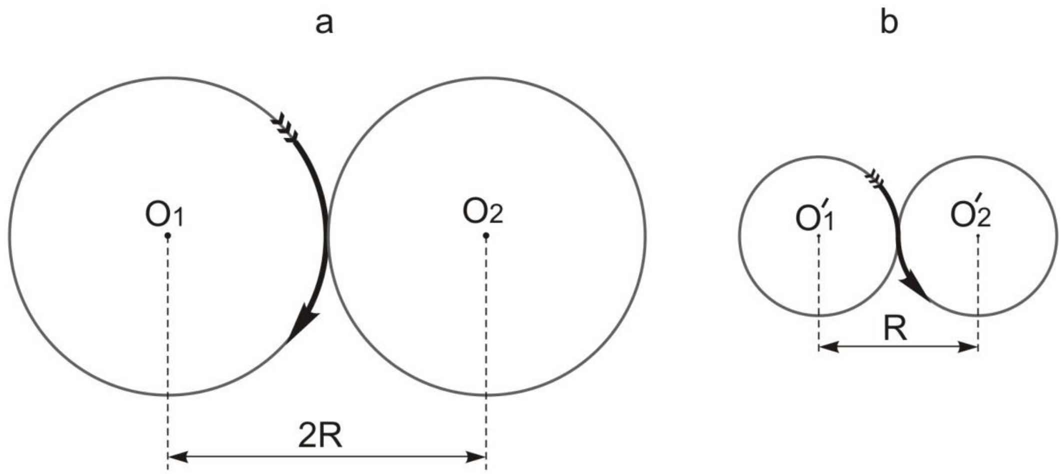

Figure 1. a) Two immovable atoms of nitrogen in contact; b) the nitrogen molecule.

considerable force of attraction, which is called chemical covalent bond, arises between atoms. Naturally, a question comes up: what is the physical nature of this bonding?

The gravitational interaction of atoms in a molecule is insignificant; one cannot take it into account. But the electromagnetic interaction also cannot explain the chemical covalent bonding. Indeed, both halves of the configurations, represented in Figure 1a and b, are electrically neutral, they cannot interact with electromagnetic forces. However, it can be noticed that, the chemical covalent bonding appears by bringing the atomic nuclei together. Hence, it can be concluded that, the chemical covalent bond is caused by the mutual attraction of atomic nuclei.

Of course, it is known that positively charged atomic nuclei are mutually pushed away. But if their positive charge is neutralized by the equal negative charge of electrons (this happens in atoms), atomic nuclei can mutually attract one another. Just with this, it is possible to explain the formation of covalent bonding of atoms in molecules.

As for chemical ionic bond, it is obliged, on the whole, to the electromagnetic bonding. In this case, the internuclear attraction (in the form of the so called nonionic contribution) takes place too (Barnard, 1965), but it is not determinative.

CONCLUSION

The internuclear interaction of atoms is a universal interaction. It is shown only in short distance between atoms, when they come in contact (so-called Wan-der-Waals' forces) and especially when they are bound in a molecule (chemical bonding).

The existence of molecules (and also of solid and liquid bodies) is obliged mainly to the internuclear attraction of atoms. With the lack of this attraction, the universe would be a very primitive and lifeless place.

It is impossible to receive the internuclear interaction of atoms from the known fundamental interactions; so, apparently, it could be considered fundamental too. The totality of the three fundamental interactions (gravitational, electromagnetic and internuclear interactions) leads to more profound understanding of the world, in which we are living.

Conflict of Interests

The author has not declared any conflict of interests.

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