Energy ratio of 1/12 and attraction in hydrogen atoms and hydrogen molecules

JianFei Chen

Abstract

As has been found: In a hydrogen atom, if the proton increase 1/12 of the total mass of the electron, then the mass ratio of proton and electron is exactly an integer of 1836; And in a hydrogen molecule, hydrogen molecular bond energy is equal to 1/12 of the kinetic energy of two electrons. Both of two attraction involve the same ratio of 1/12, which should been determined by the same rules of energy. Author has explained the format process of the two attraction with energy and energy waves. The purpose of this paper is to study the four fundamental forces with energy and energy waves. *Email: eastear@outlook.com eastear@163.com*

Foreword

Hydrogen is the first element in nature. The simplest hydrogen element comprises one proton and one electron. Two hydrogen atoms form a hydrogen molecule. For studying the nature, it is important to study hydrogen atoms and hydrogen molecules. Why do a proton and an electron attract each other? Why do two hydrogen atoms attract? Through research, author found that two attraction are from the interactions of energy.

Data

In hydrogen atoms, the electron usually moves at Bohr orbit around the proton. The electron has motion and rotation, and the proton also has motion and rotation. Since the proton's mass is much greater than the electron's mass, of the proton, the kinetic energy and the rotation energy are very small, which can be ignored. At present, the mass of the proton and electron were measured when they are at rest. Following data is about the electron at Bohr Orbit in the hydrogen atom.

Relativistic kinetic energy of the electron:

$$E_{ek} = 2hcR_\infty \tag{1}$$

According to "Uncover the logic of Fine Structure constant"[1], there is a balance between motion and rotation of the electron, and the rotation energy is $\sqrt{2}$ times of its kinetic energy [1].

$$E_{er} = \sqrt{2}E_{ek} = 2\sqrt{2}hcR_\infty \tag{2}$$

Total energy E_e and total mass of the electron m_e can calculate as follows:

$$E_e = m_e c^2$$

$$E_e = m_{e0}c^2 + E_{ek} + E_{er} = m_{e0}c^2 + (1+\sqrt{2})2hcR_\infty$$

With the values of $h, c, R_\infty, m_{e0}, m_{P0}$ can be checked in "CODATA Recommended Values of the Fundamental Physical Constants: 2014"[2] as follows:

$$h = 6.626\ 070\ 040\ (81) \times 10^{-34}\ Js$$

$$c = 299\ 792\ 458\ m/s$$

$$R_\infty = 10\ 973\ 731.568\ 508(65)\ m^{-1}$$

$$m_{e0} = 9.109\ 383\ 56(11) \times 10^{-31} kg$$

$$m_{p0} = 1.672\ 621\ 898(21) \times 10^{-27} kg$$

$$m_e = m_{e0} + \frac{(1+\sqrt{2})2hR_\infty}{c} = 9.110\ 554\ 6647 \times 10^{-31}\ kg \tag{3}$$

$$\frac{m_{P0}}{m_e} = \frac{1.672\ 621\ 898(21) \times 10^{-27}}{9.110\ 554\ 6647 \times 10^{-31}} = 1835.91664806360$$

$$= 1836 - \frac{1}{12 \times (1 - 0.022\%)} \cong 1836 - \frac{1}{12} \tag{4}$$

Two hydrogen atoms combine a hydrogen molecule, and release bond energy. In the paper "Dissociation Energies of Molecular Hydrogen and the Hydrogen Molecular Ion"[3], the bond energy of the hydrogen molecule can be checked as table 1, and the bond energy to a single hydrogen atom can calculate as follows.

$$E_{bs} = \frac{hc\nu}{2} \tag{5}$$

With equation (1) and (5), compare E_{bs} to kinetic energy of the electron E_{ek} as follows:

$$\frac{E_{bs}}{E_{ek}} = \frac{\frac{hc\nu}{2}}{2hcR_\infty} = \frac{\nu}{4R_\infty} \tag{6}$$

Then we can get the data as table 1:

	bond energy	E_{bs}/E_{ek}
H-H	36 118.05 cm^{-1}	1/12.153
D-D	36 748.34 cm^{-1}	1/11.945
H-D	36 405.82 cm^{-1}	1/12.057

Discussion

Both of two attraction involve the same ratio of 1/12, which should be determined by the same rule. They can be explained as follows:

According to the quantum Hall theories, the ratio between energies always is an integer or a simple fraction. In the hydrogen atom, mass ratio of proton and electron should be the integer of 1836. But the equation (4) shows that proton has an energy in the hydrogen atom, which matches to the mass of $m_e/12$.

$$E_{e\to p} = \frac{E_e}{12} = \frac{m_e c^2}{12} = m_{e\to p} c^2 = \frac{hc}{\lambda_{e\to p}} \tag{7}$$

According to "Uncover the logic of Fine Structure constant"[1], the electron moves at the Bohr orbit under the influence of an external vacuum field, then it causes an energy wave $\lambda_{e\to p}$ to effect the proton in the center and bound it. After the proton accepts this energy $E_{e\to p}$, the total mass of the proton is 1836 times of the electron mass m_e. When the proton and electron are separated, the proton loses this mass $m_{e\to p}$.

To the hydrogen molecule, it can be seen from Table 1 that the swing of bond energy due to the difference of the nucleus. If the influence of the nucleus is excluded, on the rules as the quantum Hall theories, the ratio in equation (6) should be as follows:

$$\frac{E_{bs}}{E_{ek}} = \frac{hc/\lambda_{bs}}{hc/\lambda_{ek}} = \frac{\lambda_{ek}}{\lambda_{bs}} = \frac{1}{12} \tag{8}$$

Energy wave λ_{ek1} is from the kinetic energy E_{ek} of one electron e_1. It causes a resonance wave $\lambda_1' = 12\lambda_{ek1}$ to bind another electron e_2;

$$\lambda_{1\to 2} = \lambda_1' = 12\lambda_{ek1} \tag{9}$$

The electron e_2 gets the energy from this wave $\lambda_{1\to2}$, and its energy becomes larger. To hold the correlations in the hydrogen atom, it will release the needless energy, which is equal to the energy of the wave $\lambda_{1\to2}$. Total energy released from both of two electrons is the bond energy of a hydrogen molecule.

Summary

Both the attraction of electron-proton and the attraction in the hydrogen molecules come from the logical ratio of 1/12 between energy. This energy logic ratio 1/12 should have many applications in the natural sciences.

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Correspondence and Requests for materials should be addressed to:

CODATA: http://www.codata.org/

iBonD: http://ibond.nankai.edu.cn/

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