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RESEARCH ARTICLE

SPECTRAL REDSHIFT OF QUASARS BASED ON THE CHANGES IN THE ELECTRONIC STRUCTURE OF MATTER INDUCED BY GRAVITATIONAL FIELD

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ABSTRACT

Focusing on the cosmological and non-cosmological redshifts existing in the quasars, in this work, we proposed that the different gravitational fields will lead to the changes of the electronic structure of matter. Therefore, the large spectra redshifts in the quasars are well explained based on the changes of the electronic structure of the matter. In the external strong gravitational field, the stable states of atoms (ions or molecules) are different from that of the earth region. The electron "orbital" energy of atoms is decreased in the strong gravitational field, leading to decrease the energy level difference between orbits, and the spectrum shows red shift. Because the orbital energies are proportionally decreased, the atomic spectrum in the strong gravitational field is still to exhibit the characteristic spectrum of the same atom in the earth region, that is, only the whole red shift occurs. We proposed that the different atomic stable states exist due to the different gravitational field intensities, which are discontinuous and gradient. It usually presents as the different quantum states. The quantum states in the earth region are only one of the several quantum states in the universe. Our proposed theory can not only perfectly explain the spectral redshift characteristics and nature of quasars, but also draw the conclusion that the gravitational field changes the matter structure.

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INTRODUCTION

There are two kinds of explanations about the essential causes of spectral redshift in astrophysics, one is cosmology and the other is non-cosmology (He Xiangtao, 1990). The redshift determined by the rate of retrogression is a kind of cosmological effect, so it is called cosmological redshift. Because its physical mechanism is Doppler effect, it is also often called "Doppler redshift" or "velocity redshift". Since the advent of Hubble's law in 1929, scientists have applied Hubble's law to the redshift of spectral lines in a large number of extragalactic galaxies and a large number of measured results also confirm its applicability. So it is generally believed that the nature of redshift of extragalactic galaxies spectral lines is Galaxy retrograde Doppler effect (Bian Yulin, 1994 and Liang Enwei, 2002). A more representative example is the observation around the energy field for four different redshift galaxies, NGC 7603 ($z = 0.029$), NGC 7603B ($z = 0.029$) and the two darker emission galaxies ($z = 0.245$ and $z = 0.394$) by M. Lopez-Corredoira et al. By comparing the evolution of holes formed under the standard cosmological model and two different cosmological models, the anomalous redshift of their spectral lines was explained by cosmological redshift (Lopez-Corredoira1, 2004). Rodin et al. studied the cosmological redshift relation between the mass of black hole nuclei and the nuclei of active galaxies (Ro Dan, 2015). Popowski Piotr et al. also believe that quasar redshifts have cosmological properties. They propose two scenarios for the origin of redshifts: (1) variations in cosmological scaling factors (standards, cosmological scenarios) and (2) Doppler shifts (local ejections) caused by the speed of the spectra of the nearby objects. Based on these investigations, the relationship between the origin of redshift and the maximum possible intrinsic motion of quasars under cosmological and local conditions is raised. More than 8000 near quasar-galaxy combinations are predicted (Popowski, 2004). However, the astronomical observations of the quasars show that the spectra of quasars present very larger redshift. For instance, the redshift of quasar OQ172 can reach 3.53. If the origin of the redshift is cosmological, according to Hubble's law, this quasar is moving away from us at a speed of 0.9c. Meanwhile, the distance of the quasar from us is tens of billions of light-years, and its optical luminosity will be as high as 10-10erg/sec if the redshift is explained by Doppler effect.

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Therefore, Doppler effect of the quasar's redshift infers that the galaxies and quasars around us are moving outward. The farther away they are, the faster they are. So it is expected that the universe we observed is expanding (Yang Lantian, 1980). Moreover, some observations showed that the several redshifts of the absorption line are smaller than that of the emission line. Meanwhile, several "cohort" quasars have great differences in redshift values and the amount of quasars is characterized by peak values according to redshift distribution (Pan Caijuan, 2013). In fact, it is very difficult to interpret these characteristics by cosmological redshift. Thus, astronomers, such as Wolf Emil, Russell David G et al, believed that quasar redshift has or at least partly has non-cosmological redshift characteristics (Huang Keliang, 2005, Wolf, 1987 and Hartnett, 2009). Based on the rapid radio burst (FRBs), Liam Connor et al. explained the spectral redshift of the residual star pulse in the supernova using non-cosmological concept (Liam Connor, 2016). There were also some non-cosmological explanations for the asymmetric redshift of quasars based on the principle of gravitational lensing (Russell, 2005 and Lopez-Corredoira, 2004). D. Basu investigated the asymmetric redshift of quasi-stellar objects (QSO) and proposed that the asymmetric redshift is caused by the action of gravitational lensing (Basu, 2009). Ionescu and Mircea investigated the main causes of the redshift of cosmic radiation and proposed that the redshift of radiation is a multiple loss of energy. The redshift of radiation in the form of total redshift may be either a velocity-dependent or non-velocity-related cause, and does not support the basic argument of the inflated cosmological model (Ionescu, 2008). Zackrisson E. indicated some subgroups of bodies may contain significant non-cosmological redshift components which was unrelated to the cosmic expansion (Zackrisson, 2005). Prieto Joaquin, by using adaptive mesh refinement cosmic fluid dynamics simulation, investigated the processes of high redshift mass transport in galactic nuclei with the RAMSES program. They explained the formation mechanism of quasars with the redshift values of 6-7 (Prieto, 2016). All in all, although the spectral redshift observations of various stars and quasars in astrophysics can be used to infer the scale of the universe, the origin and evolution of the universe, and also the physical nature of active galaxies, the nature and origin of redshift of quasars have not been universally recognized by researchers. Therefore, exploring the essence of quasars redshift will be theoretical and astrological significance. It may become a new way to explore the evolution of quasars. In this paper, we focused the larger red shift of the quasar. The influence of gravitational field on the structure of atomic electron orbits was explored. We proposed a gravitational structure non-cosmological red shift nature by analyzing and studying the formation mechanism of the red shift both in absorption and emission lines.

Non-cosmological Redshift principle and Quasar Redshift Analysis

Because the gravitational force is very weak than the electromagnetic force (10^{-37}), the gravitational action between the nucleon and electron in the atom is generally not considered. However, when the atom is in the external strong gravitational field, the influence of the gravitational field on atomic structure had to be considered. The extreme examples of the strong gravitational field affecting the nuclear structure and atomic structure of matter are the neutron star and the white dwarf star.

Our previous work has discussed in detail the influence of gravitational field on matter structure (Meng Fan-zhi, 2015). Due to the change of celestial environment in the universe, the intensity of gravitational field will change greatly. In a strong gravitational field different with the field strength in the earth region, the electron orbital energy of an atom (or ion) is different from that of the same atom in the earth region. The atomic electron orbital energy in the strong gravitational field will be decreased, and the stronger the gravitational field is, the lower the atomic electron orbital energy is. Meanwhile, the energy difference between orbits also decreases, and all orbital energies decrease proportionally. However, the atomic spectrum is still characterized by atomic characteristic spectrum in the earth region, only being a redshift. Conclusively, the red shift of atomic structure caused by the intensity change of gravitational field is donated as "gravitational structure red shift".

The atoms in different gravitational field intensity have different stable quantum states. However, the Schrodinger equation or Rydberg (Jonathan Tennyson, 2005) equation is still applicable at this time, only the quantum conditions are different from that in the earth region. The quantum conditions of different gravitational fields are discontinuous and gradient, so several stable regions of quantum conditions are formed. Importantly, the earth region is only one of the several quantum condition regions. In the model of quasar black hole and accretion disk, the wide line region and narrow line region are all in the strong gravitational field of quasar. The atomic (or ion) electron "orbital" energies in the wide or narrow line region are all decreased. Concordantly, the differences between two orbit energy levels are decreased while all the orbital energies are reduced in proportion. Consequently, a new quantized region is formed, very different with that in the Earth. Therefore, a redshift will be produced during the transition between the reduced orbits energy levels. We donated the redshift as "gravitational structure redshift" because it caused by the intensity change gravitational field. As well-known, the Rydberg spectral formula is as follower (1):

$$\frac{1}{\lambda_0}=R_H\left(\frac{1}{n_1^2}-\frac{1}{n_2^2}\right) \quad \text{……………………(1)}$$

Therefore, for quasars, we consider it is also suitable for quantum mechanics theory whereas the corresponding Rydberg constant is different. Thus, the formula of spectral energy level is expressed as formula (2), and formula (3) is the value of absorption and emission redshift.

$$\frac{1}{\lambda_Q}=R_{HQ}\left(\frac{1}{n_1^2}-\frac{1}{n_2^2}\right) \quad \text{………………………(2)}$$

$$Z=\frac{\lambda_Q-\lambda_0}{\lambda_0} \quad \text{……………………….(3)}$$

Therefore, summing the formula (2) and (3), the quasar Rydberg constant R_{HQ} can be deduced by $R_{H_Q}=\frac{R_H}{Z+1}$.

For example, for QSOQ1422 231, it is found that the red shift of the lyα emission line is Z =3.625 [Huang, 2005]. If the red shift is all assigned to the gravitational structure variety, then

$R_{H_Q} = \frac{R_H}{Z+1} = \frac{109677.581 cm^{-1}}{3.625+1} = 23714.071\ cm^{-1}$, and then $\lambda_Q = 5622$ Å by calculating with the formula $\frac{1}{\lambda_Q} = R_{H_Q} \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right)$. There exist different atomic (or ionic) structures in the different gravitational field environments, and thus the different wave function solutions. Because all orbital energy of atoms in the emitter region of quasars decreases proportionally, the values of the redshift emit by each quasar is the same [9]. So the Rydberg constant is suitable for all orbital transition spectral lines of atoms of this kind of stars, as well as other emission lines and absorption lines with consistent redshift values. If the cosmological redshift is assumed, the moving of the quasars with the larger redshifts will be close to the speed of light, so it is unreasonable. We can infer that part of the larger redshift of the spectral shift for quasar may be attributed to the electronic structure change caused by the variety of the gravitational field intensity.

In the case of the redshift Z_a for the absorption line of the quasar equals to Z_{em} for emission line, it can be classified as intrinsic absorption. In the case of $Z_a < Z_{em}$, it can be explained as that the absorption region is always far away from the quasar nucleus and away from the strong center of the gravitational field than the emitter region. Therefore, the gravitational field in the absorption region is weaker than the gravitational field in the emitter region. The atomic orbital variation in the absorption region is smaller than that in the emission region, and the difference of the atomic orbital energy in the absorption region is smaller than that in the emission region. Consequently, the red shift value of absorption spectrum is smaller than that of the emission spectrum.

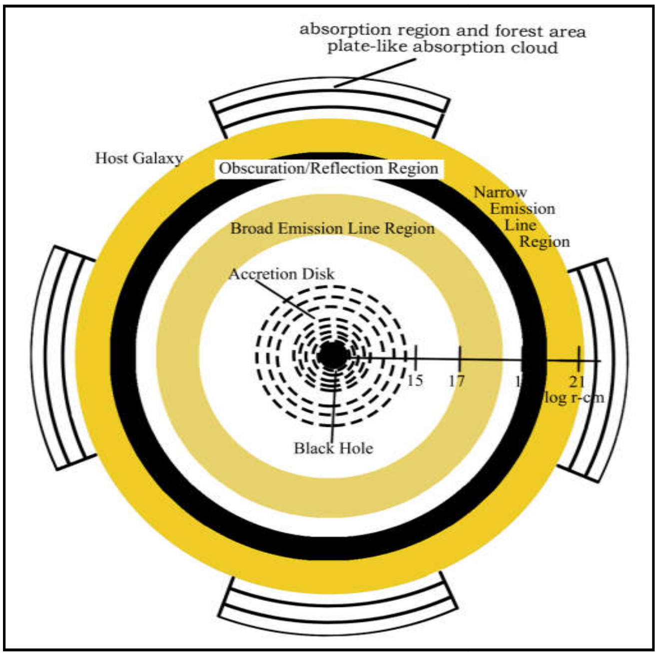

Figure 1. The onion expansion model of the active galactic nuclei in quasar

Meanwhile, because the distance between each absorptive region and quasar is different, each absorption region has its own gravitational field environment. The farther away from the quasar core, the smaller the gravitational field intensity is. The red shift of absorption line will become small, and then, the "multiple absorption" occurs. Based the above discussion, we propose a new model in which a layer of "absorption region and α forest plate absorption cloud" should be added outward the "narrow emission line" of the quasar "onion" model [Huang, 2005]. That is, an unclosed, multi-level absorption cloud is from the inside to the outside. The "onion" expansion model of quasar active galactic nucleus is illustrated in Figure 1. With this proposed model, we well explained the phenomenon that the red shift values in the absorption line is less than that in the emission line as well as the phenomenon of multiple absorptions. We also used this model to explain the five X-rays resources of NGC3516 successfully, that is, if the source is closer to the NGC3516, the red shift value will be larger. Because the gravitational field will be stronger for the closer region of NGC3516, thus it leads to the larger atomic orbital changes and thus the redshift increases. The process of matter structure change caused by the change of gravitational field intensity is illustrated in Figure 2. This phenomenon can also be applied to the statistical study of quasars, where the number of quasars reaches a peak value at Z=0.3, 0.6, 0.96, 1.41, and 1.96 according to the distribution of the redshift degree. It is indicated that the quantization conditions in the different gravitational field intensity regions are limited and require gradient quantization. Therefore, it can form the N quantization numerical stable regions with the above matter structures, and the earth region is only one of the quantum-state condition regions. The redshifts of the two cohort quasars are very different, which can also be attributed to the difference of the redshift caused by different gravitational field environments in the emission or absorption regions of the two quasars. The apparent velocity of the NGC53 in the bright junctions is 32744 km/s higher than that of the main galaxy, which can be interpreted as "gravitational structure redshift". If a quasar has a host galaxy, the redshift of a quasar could be different from that of its host galaxy according to the "gravitational structure redshift". Even in the Galactic system, near the center of the Galactic system, the conditions in which large gravitational fields exist in the emission and absorption lines regions make the gas clouds neither collapse nor escape, and under these conditions a redshift could occur. This redshift is not cosmological red shift, but bonds to the red shift caused by gravitational structure, so we speculated that non-cosmic gravitational structure redshift should be found in the Galactic system.

This is only a qualitative explanation of the atomic structural changes caused by the change of the gravitational field strength, which requires a great deal of data to quantify. For the different stable regions of quantum states, if the cosmological redshift in the total redshift can be quantitatively removed out, the condition regions of the quantum states could surely be quantified by using the redshift data of the gravitational structure. Because the gravitational force is very weak than the electromagnetic force (10^{-37}), so the gravitational interaction between the nucleus and the electron is not considered in the atom itself, but for the strong gravitational field outside the atom or in the strong gravitational field environment outside the atom, the influence of the strong gravitational field have to be taken into account. Consider extremely strong gravitational conditions, such as the inner neutron star, where the strong gravitational field changes the matter structure. It is an example of the near limit of the gravitational field changing the matter structure. So in the region of the strong gravitational field outside the star, the electron "orbital" energy of the atoms (or ions) in the gas cloud that is not absorbed into the stars but also not escape will be changed. Therefore, in this case, the influence of the external gravitational field on the atomic structure should be surely considered.

redshifts of the quasars should be redshifts of non-cosmological gravitational structures. At the same time, because of the different intensity of gravitational field, there exists quantization condition region with different numerical

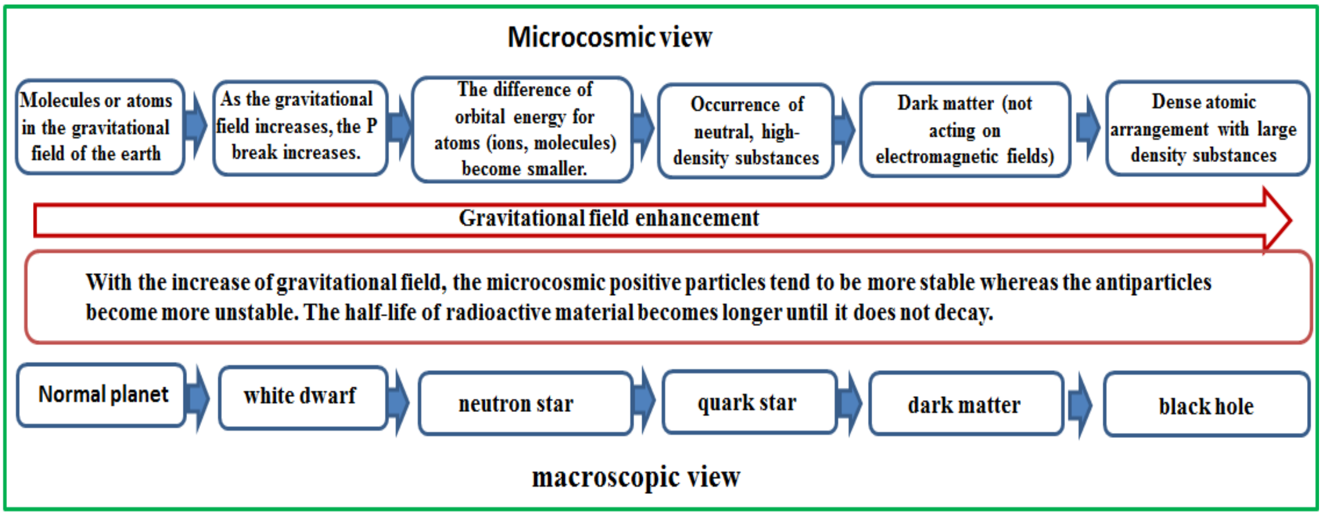

Figure 2. Schematic diagram of the microscopic matter structure varied with the change of gravitational field

gradient, and the earth region is only one of the quantization condition regions. Therefore, the change of the intensity of gravitational field leads to the change of atomic structure, which leads further to the redshift of quasar spectrum, so we call it "gravitational structure redshift". Our proposed non-cosmological "gravitational structure redshift" of the quasar can perfectly explain the spectral redshift characteristics and nature of the quasars, which is of great significance in the theory of celestial spectral cognition and matter structure.

Actually, the influence of gravitational field on matter structure can be verified or falsified. We can verify the influence of gravitational field on the matter structure by the following experiments. One is the experiment of the lifetime of the positive or antiparticles and the other is the experiment of symmetry P breaking. First of all, because the gravitational field in the earth region is enough strong to change the lifetime of the positive or antiparticles. Thereby the lifetime of the antiparticle is certainly shorter than that of the positive particle. However, because the gravitational field in the earth region is relatively weak, the lifetime difference of the positive or the antiparticle is not very obvious. So it is difficult to determine almost trace differences during the current experimental test of the average lifetime. Thus in the current theory, the lifetime of both positive and antiparticles is strictly equal. We guess the specific experiments could confirm that the antiparticle lifetime is shorter than that of the positive particle due to the difference of gravitational field if the decay particle pairs are well selected. At the same time, we know that the gravitational field makes the parity P break. The stronger the gravitational field leads to the greater the degree of breaking. So by the cobalt 60 experiment, it will be found that the breaking degree should be different when the tidal force is the largest or the minimum. In fact, white dwarfs, neutron stars, and quark stars are all natural examples and proofs that the gravitational field changes the matter structure.

Conclusion

Summarily, focusing on the essential origin of the larger redshift of the quasar spectrum, we have investigated the fundamental cause of the redshift in the quasar spectrum. We proposed that there is a non-cosmological redshift component in the quasar spectrum, which can be attributed to the gravitational structure redshift. Due to the change of the gravitational field environment and the increase of the gravitational field intensity of the celestial body, the orbital energy levels are lowered and their deference decrease in the atom (or ion). In this case, the spectrum presents the redshift of the atomic characteristic spectrum. The stronger the gravitational field is, the greater the red shift is. Most of the

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