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Article 2: The particle dualism of electromagnetic waves /电磁波的波粒二象性原理

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1.The wave-particle duality of electromagnetic waves

Magnetic mass lines in micro-particle structure: the concept of magnetic mass line is proposed in this paper. The magnetic mass line in three-dimensional space of micro particles is a function of the spatial distribution of both mass and magnetic field (magnetic fields can be measured by electric charges). Therefore, the geometric center of the spatial distribution of the magnetic mass line within the micro particle (such as a molecule) is not only different from the geometric center point of mass spatial distribution, but also different from the geometric center point of the spatial distribution of electric charges; it is the interaction point of the doubles. The geometric center point of the magnetic mass line is exactly the center point of the rotation motion of the materials aggregated as a whole (such as the rotation motion of electrons in atom, molecule revolution motion discussed above, or celestial rotation motion). It can be inferred that the geometric center of the magnetic mass line in a atom is not the center of the nucleus, which can only be interpreted to be closer to the nuclear center point, because the electron mass is much smaller than the nuclear mass, and the nuclear center point is closer to the geometric center point of the whole atomic mass. Therefore, it is too simple to simplify that the internal motion of the electron in an atom is defined as the rotation of the electrons around the nucleus. In fact, both the nucleus and the electron rotate around the geometric center of its magnetic mass line of an atom. This provides a basis for the theoretical calculation of rotational motion in astrophysics and the optimization of synthetic structure of polymers by 3D simulation of molecule movement.In addition, since the nucleus of positive charge and the electron of negative charge rotate around the geometric center of the magnetic mass field line in atom respectively, the characteristics of electromagnetic waves generated by each rotation should be significant different in the element properties of electromagnetic waves from each other, which needs to be further discussed. This is of great significance to the application on the electromagnetic spectrum analysis in the next.

For example, the characteristics of the γ rays should be revealed as the electromagnetic waves generated by the positively charged protons rotating around the spin center inside the atomic nucleus, which is different from the rotation center of the whole atom. The rotation center of an whole atom is the common rotation center of both the nucleus and the electron, whereas the inner spin center of the nucleus is the spin center of the elementary particles in the nucleus. Compared to the electromagnetic spectrum produced by electrons, the electromagnetic waves produced by γ ray does not only have shorter wavelengths and higher frequencies because of their smaller rotation radius, but also leads to higher penetration capacity due to its energy of higher intensity in nucleus, and the energy of electromagnetic waves produced by nucleus is much higher than the electron consequently. In this paper, it is to further present that the electromagnetic wave produced by the rotation of positively charged protons around the spin center inside nucleus transmits at faster speed than the electromagnetic wave produced by an electron rotating around the spin center of an whole atom. Further because of the electric charge difference between the positively charged protons and the electrons, the wave crest peak and the wave trough bottom point have opposite polarity between these two electromagnetic waves respectively. This is the main reason why the γ ray penetration capacity is high. For example, if the wave peaks of the electromagnetic waves produced by the nucleus are defined as the anode and the bottom points of waves are defined as the cathode respectively, then the peaks of the electromagnetic waves produced by the electrons are defined as the cathode and the trough bottoms are the anode correspondingly. Γ Radiation of high energy flow density can easily neutralize and penetrate the electromagnetic waves generated by electrons when they transmit to meet each other in the opposite direction. Therefore, for the wave-particle duality analysis of electromagnetic waves, the polarity of the peaks and bottoms of waves should be analyzed as a basic element in this paper, which is different from that of mechanical waves.

For example, according to the experimental data, the electron resonance frequency is measured to be 8.41GHz under the main magnetic field environment of 0.3T, while the proton resonance frequency measured by common nuclear magnetic resonance (NMR) is only 12.77MHz [1]. In further comparison, the frequency of the γ ray is above 10^{20}Hz [2]. γ rays is the electromagnetic waves generated by the proton rotating around the spin center inside the atomic nucleus, while the NMR frequency of proton reflects the electromagnetic wave generated by the protons rotating around the whole atomic spin center, and electron resonance frequency represents the electrons rotating around the whole atomic spin center. Therefore, it is easy to deduce that the angular frequency of proton rotation around the spin center inside the atomic nucleus is much greater than the angular frequency of proton rotation around the whole atomic spin center, and is also much greater than the angular frequency of electrons rotation around the whole atomic spin center. The angular frequency of electrons rotation around the whole atomic spin center is significantly higher than the angular frequency of protons rotation around the whole atomic spin center.

Comparing and contrasting between light wave and α Ray, β Ray, γ ray: light wave is a kind of electromagnetic wave with shearing and transverse wave nature, and itself does not produce electric current effect, but it is capable of producing photoelectric effect through propagation medium such as specific electrical conductors; Ray is a type of electromagnetic wave with longitudinal wave nature. When the emission frequency of ray changes (not constant), it is to generate the pulse electromagnetic wave, which further results in current effect. Therefore, the electric current can be detected without medium in the propagation direction of electromagnetic wave as rays. Rays travel faster than light waves with stronger penetration. My another paper has discussed in detail that the current effect propagates in the form of electromagnetic wave energy flow [4].

Further discussion: compared with the electron, the radius between the proton and the rotation center in the nucleus is shorter, and the rotation speed is higher, so the energy flow intensity of electromagnetic wave is higher, and the transmission speed of electromagnetic wave is faster. It has been discussed in my previous paper that the refraction or diffraction of light is caused by the interference influences between the magnetic field on the obstacle surface and the polarity of light wave, which is different from mechanical wave. Therefore, different characteristics of materials generates different light refraction or diffraction angles. This is also applicable on the other frequencies of electromagnetic wave.

My another article has originally created the electromagnetic mechanism of light refraction, diffraction and reflection [3]:

"Further discussion: compared with the electron, the radius between the proton and the rotation center in the nucleus is shorter, and the proton rotation speed is higher, so the energy flow intensity of electromagnetic wave is higher, and the transmission speed of electromagnetic wave is faster. The refraction or diffraction of light is caused by the interference influences between the magnetic field on the obstacle surface and the polarity of light wave, which is different from mechanical wave. Therefore, different characteristics of materials with different magnetic field on the surface generates different light refraction or diffraction angles. This is also applicable on the other frequencies of electromagnetic wave. These findings provide basic characters for the synthesis of new materials. As discussed in Figure 1, the vertical red line represents the boundary between medium A (left) and medium B (right); magnetic field B in the medium A is vertical to the magnetic intensity curve (on the plane by axis y and z) of electromagnetic wave; electric field E in the medium A is vertical to the electric intensity curve (on the plane by axis x and z) of electromagnetic wave; in medium A, the transmission direction of electromagnetic wave V is parallel to axis z. Once the electromagnetic waves passes from medium A (left) into medium B (right), the direction of magnetic field B in medium B is different from it in medium A, so that the magnetic field B in medium B alters the transmission direction of electromagnetic wave V, making the magnetic field B in the medium B vertically to the magnetic intensity curve of electromagnetic wave in medium B. This is the mechanism of light refraction, which is also applicable on the light diffraction.

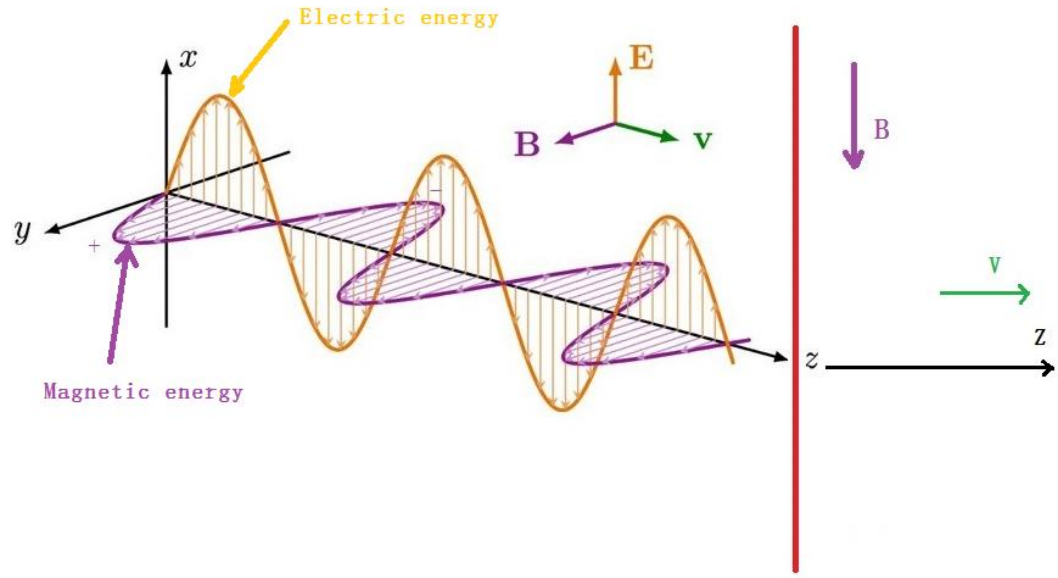

Figure 1. The mechanism of light refraction from medium A (left) to medium B (right) with the boundary of vertical red line between them.

This paper further discusses the electromagnetic wave principle of light reflection phenomenon: as proposed in my another article [6], the overall structure of an atom yields the effects of neutral shielding on the elementary particles inside the atoms. This neutral shielding effect is completely understandable: if the neutral shielding effect does not exist, when two atoms collide, the electrons of one atom are attracted by the nucleus of the other atom because of the Coulomb force, thus merging and neutralization. This is obviously not the facts, so the existence of this neutral shielding effect can be proven inversely according to the fact. The shielding effect of both molecular structure [5] and the electronic orbitals [7] have also been discussed in my other papers. Therefore, this paper further deduces that the neutral shielding effect of the whole atomic structure is the electromagnetic wave principle of the light reflection phenomenon. The stronger the reflection effect of light on the surface of the object, the higher the neutral shielding capacity of the object atoms. In my quantum chemistry paper [7], it is to point out that the shielding effect of electronic orbits relative to adjacent orbitals is generated during spinning motion. Consequently, this paper further deduces that for the atoms of the same element in different molecular structures, because the electron orbitals forming chemistry bonds, molecular bond angle, bond energy and bond length vary among different molecular structures, even for the atoms of the same elements, the neutral shielding effect will be different in different molecular structures.

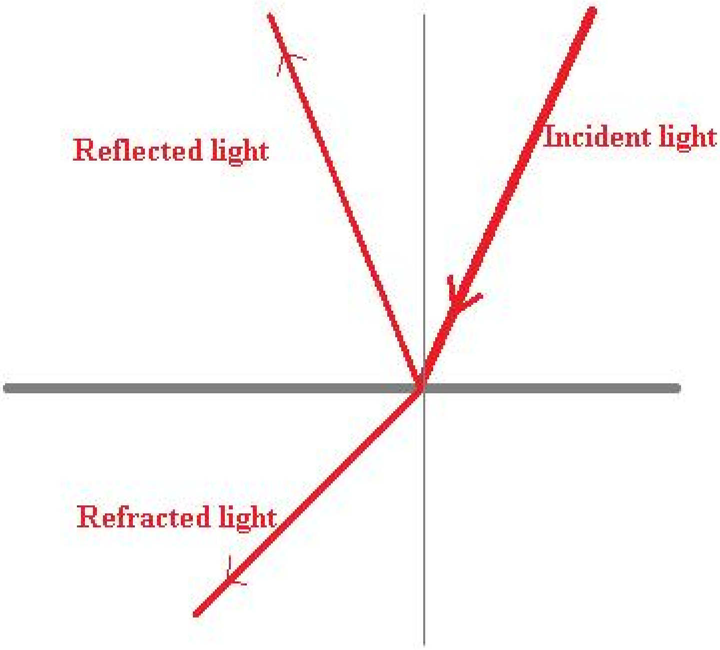

Figure 2. This figure illustrates the relations among incident light, reflected light, refracted light.

As shown in Fig 2, the incident light is divided into reflected light and refracted light after the incident light penetrates the surface of medium substance. If the neutral shielding effects generated by the atoms of medium substance is stronger, then the intensity of reflected light is stronger and the refracted light intensity is weaker correspondingly.”

More over, because our three-dimension space is curved sphere, all the remote objects observed by us are the enlarged images due to the magnifier effects, so the astro-observation data have to be corrected. The electromagnetic wave transmission speed (such as light speed) varies between different magnetism fields (NOT constant), which leads to significant effects on the astro-observation data. These two effects require corrections of data received by astronomy observations.Otherwise it is too different significantly from the real data.

译文：微观粒子结构中的质量磁力线：本文提出质量磁力线概念，微观粒子三维空间中的质量磁力线为质量空间分布和磁场量（可以电荷量衡量）空间分布的函数。因此微观粒子（比如一个分子）的质量磁力线的空间分布几何中心既有异于质量空间分布的几何中心点，也不同于电荷量空间分布的几何中心点；而是二者的相互作用点。而这个质量磁力线的空间几何中心点正好是物质集合体自转运动的中心点（不管是微观原子、分子自旋运动，还是天体旋转运动）。可以推测出，简单原子中的质量磁力线几何中心不是原子核的中心，仅仅可以定义为更加接近于原子核中心点，因为电子质量相对于原子核的质量小很多，原子核中心点近似

于整个原子质量几何中心点。所以电子内部运动简化为电子围绕原子核做自转运动也是过于简单的理解。其实是原子核与电子围绕其质量磁力线几何中心做自旋运动。这对于天体物理学中旋转运动理论计算和高分子合成结构的优化提供了理论依据进行 3D 分子运动模拟。另外，由于正电荷的原子核与负电荷的电子共同围绕原子的质量磁力线几何中心做自转运动，因此两者各自由于自转产生的电磁波的基本要素特性有显著不同，有待进一步论述。这对下一步物质的电磁波谱分析的应用有重要意义。

比如，γ射线的特性应当揭示为正电荷质子围绕原子核内自转中心做自转运动产生的电磁波，原子核内自转中心不同于整个原子的自转中心。原子的自转中心是原子核与电子共同的自转中心；原子核内自转中心是原子核内基本粒子围绕自旋的中心。与电子产生的电磁波谱相比，γ射线产生的电磁波不仅由于自转半径更小导致波长更短，频率更高，而且由于其能量集中导致其穿透性、与能量远远高于电子产生电磁波。本文进一步认为正电荷质子围绕原子核内自转中心做自转运动产生的电磁波与电子围绕整个原子的自转中心旋转产生电磁波相比，传播速度更快（两者电磁波传播速度不会相同），而且由于两者之间的电荷相异，电磁波的波峰点和波谷点所带极性在两种电磁波之间也相反。这就是为什么γ射线穿透力很高的主要原因。比如，如果原子核产生的电磁波波峰定义为阳极，波谷定义为阴极；则电子产生的电磁波波峰定义为阴极，波谷定义为阳极。能量流密度很高的γ射线从逆向传播方向与电子产生的电磁波相接触，则可以容易中和并且穿透。因此对于电磁波的波粒二象性定理，本文应当把波峰与波谷的极性作为基本要素进行分析，这与机械波有所不同。

比如根据实验数据，在 0.3T 的主磁场环境背景下，电子共振频率测定为 8.41GHz，而对于常用的核磁共振的质子共振频率仅为 12.77MHz[1]。相对比而言，γ射线的频率则为高于 10^{20}Hz[2]。其中γ射线是质子围绕原子核内自旋中心旋转产生的电磁波，而质子核磁共振的共振频率则反映质子围绕整个原子自旋中心旋转产生的电磁波，电子共振频率则反映电子围绕整个原子自旋中心旋转产生的电磁波。因此很容易推测出，质子围绕原子核内自转中心旋转角频率远远大于质子围绕整个原子自旋中心旋转的角频率，并且也远远大于电子围绕整个原子自旋中心旋转的角频率。电子围绕整个原子自旋中心旋转的角频率则显著大于质子围绕整个原子自旋中心旋转的角频率。

对比光波与α射线、β射线、γ射线的区别：光波是一种横波性质的电磁波，本身不产生电流效应，但是经过特定电导体等传播介质可以产生光电效应；射线是一种纵波性质的电磁波，当射线的发射频率变动时（非恒定），可以产生脉冲电磁波，并且进一步产生电流效应，因此射线在电磁波传播方向上不需要介质，即可以探测到电流。射线传播速度高于光波，并且穿透力更强。本人另一篇论文详细论述了电流效应是以电磁波能量流形式传播的[4]。

进一步论述：与电子相比，原子核中质子与自转中心之间的半径更小，自转角速度更高，因此产生的电磁波能量流密度更大，电磁波传播速率更快。之前文章已经论述，光的折射或是衍射现象是由于障碍物表面磁场与光波极性的干涉作用产生的，这与机械波不同。因此不同特性的材料都会产生不同的光的折射或是衍射

角度。

本人另一篇论文中已经对光的折射、衍射和反射三大定律的电磁学原理进行了原创性的创新工作[3]：

“进一步论述：与电子相比，原子核中质子与自转中心之间的半径更小，质子自转角速度更高，因此产生的电磁波能量流密度更大，电磁波传播速率更快。光的折射或是衍射现象是由于障碍物表面磁场与光波极性的干涉作用产生的，这与机械波不同。因此不同特性的材料由于表面磁场不同会产生不同的光的折射或是衍射角度。这种特性对于其它频率电磁波的折射或是衍射也同样适用。这些发现将为新材料研发提供了基础特性。如图 1 所述，垂直红线表示介质 A（左边）与介质 B（右边）之间的边界。介质 A 中的磁场 B 垂直于电磁波的磁场强度曲线（在 y-z 轴构成的平面上），介质 A 中的电磁 E 垂直于电磁波的电场强度曲线（在 x-z 轴构成的平面上），在介质 A 中电磁波 V 的传播方向与 Z 轴平行。一旦电磁波 V 从介质 A（左）穿透至介质 B（右），在介质 B 中的磁场 B 的方向不同于介质 A 中的磁场 B 方向，因此介质 B 中磁场 B 更改了电磁波 V 的传播方向，使得介质 B 中的磁场方向与介质 B 中传播的电磁波 V 相互垂直。此类光的折射原理同样适用于光的衍射。

本文进一步探讨光反射现象的电磁波原理：本人在另一篇期刊论文中论述了原子的整体结构对原子内部的基本粒子产生了中性屏蔽作用[6]。这种中性屏蔽作用是完全可以理解的：如果中性屏蔽作用不存在，则两个原子之间发生碰撞时候，其中一个原子的电子就会因为库仑力的作用与另一个原子的原子核相吸引，从而合并而中和。这与事实明显不符，所以可以反证出这种中性屏蔽作用的存在。本文在其它论文中也已经探讨了分子结构[5]和电子轨道[7]的屏蔽作用。因此，本文进一步推断，原子整体结构的中性屏蔽作用是光的反射现象的电磁波原理。光在物体表面的反射效应越高，反映出物体原子的中性屏蔽能力越高。本人在量子化学一文中[7]，描述了电子轨道相对于相邻轨道产生屏蔽作用。因此本文进一步推导出对于同类元素的原子在不同分子结构中，由于形成化学键的电子轨道、分子键键角、键能、键长都会由于分子结构的差异而不同，所以即使是同类元素的原子，在不同分子结构中产生的中性屏蔽作用都会相异。

图 2 例举说明了入射光、反射光、折射光三者关系。当入射光穿透介质表面之后，入射光可以被分成折射光和反射光。如果介质物质的原子产生中性屏蔽作用越强，则反射光光强越大，折射光光强相应越弱。”

再一步延伸，因为我们所在的三维空间是曲型球体，因此产生了放大效应；并且由于电磁波传播在不同星系中由于磁场相异，传播速度是非恒定的。这对于天文观察数据而言，需要进一步进行数据修正，否则相差甚大。

Pleased note: This is the revised materials in book “Proceedings for Degree of Postgraduate Diploma in Environmental Science (3rd Edition).” published in 2016. Secondly Revised on 31/12/2020;Thirdly Revised on 06/10/2021; Fourthly Revised on 24/10/2022; Fifthly Revised on 25/10/2022; Seventh Revised on 26/10/2022; Eighth Revised on 31/10/2022. This journal article is previously published as: Liu Huan. (2021). The particle dualism of electromagnetic waves. Journal of Environment and Health Science (ISSN 2314-1628), 2021(2)., which is converted into Journal of Quantum Physics and Materials Chemistry (ISSN2958-4027) . Both Journals belong to the same publisher, Liu Huan. The previous journal article is closed to the public, but the previous reference is still valid. Latest revised on 23/05/2023; 24/05/2023; 17/08/2023; 26/02/2024.

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