Diffraction and Light-Emission of Electrons

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Abstract
Already Newton had proved in his diffraction experiments that light never can be a wave and he excluded indeterminism. For establishment of diffraction is offered the photon with structure and its field their interaction causes a change of direction by hindered field with use of vortex-dynamics. This is transferable on other particles by consideration that at photons determine their frequency the diffraction-figure and at other particles their velocity. If electrons change their velocity or direction, then can be tied off field-lines analogous Hertz's dipole emission, and then photons can be emitted.

I. Newton's diffraction-experiments

Newton's [1] and Fresnel's [2] diffraction experiments were verified by Nieke [3]. Newton reported completely and truly about diffraction. Fresnel could calculate with Fourier's theorem two border-line cases and only in their sphere of validity he reported about experimental results without hints to deviation outside. Exact that is the point here, since the formula for diffraction at slit with outer diffraction-fringes in large distances was extrapolated to the distance nought, therefore to the slit-plane. The result is known: The slit limits a wave-front and every point of this wave-front goes out a sphere-wave. Newton [1] III observation 10 proved at the triangular-slit that in short distances first inner (inside or outside of shadow-limits) diffraction-fringes appear which correspond to diffraction at half-plane with the slit-edges as half-plane. With the transition of inner diffraction fringes into outer fringes in large distances he had proved that the extrapolation was inadmissible. Then Newton [l] III observation 5 proved with the localization of bent light that bent light comes only from small (he estimated 0.03 mm) surroundings of edge. Therefore the extrapolation is wrong too (particulars by Nieke [3]).

Newton's diffraction experiments could not be explained neither with (punctiform) light-particle nor with waves. So text-book authors off about 1850 simple left out Newton's diffraction experiments and spreaded so an incomplete and misleading theory of diffraction with an inadmissible and wrong extrapolation of diffraction at slit.

Bohr [4] built up his Copenhagen interpretation on Fresnel's theory of diffraction and light-electric effects with dualism of wave and particle (but Newton proved with the transition inner to outer diffraction-fringes that light never can be a wave) and indeterminism in quantum processes (but Newton proved localization of bent light in narrow surroundings of edge and refuted with it indeterminism). Generalizations to matter Bohr carried out later. The Copenhagen interpretation is, least in diffraction, so without foundation and therefore the basis of quantum-theory is new to examine.

II. Diffraction and vortex-dynamics

Nieke [5] tried an interpretation of Newton's diffraction experiments with photons with structure and field as change of direction by vortex-dynamics and self-interaction of photons with their field.

Sommerfeld [6] showed that in vortex-dynamics interaction is not determined by acceleration but by velocity. Sommerfeld [7] could transform the classical wave-equation and the Schrödinger wave-equation so remained as essential difference, besides the factor i h, only classical wave-equation in the second derivation to time and Schrödinger wave-equation in the first derivation to time. By Nieke [5] Sommerfeld [6] and [7] together gave the possibility that the Schrödinger wave-equation can be a formula of vortex-dynamics.

Barut [8] wrote about '50 years past the Schrödinger-equation': „The debate over this interpretation and its philosophical, physical and mathematical ramifications still goes on and will continue until perhaps quantum mechanics is embedded in a more general physical theory".

III. Diffraction of light and matter

At diffraction of light the frequency determines the appearance of figure of diffraction and additional at slit or grating the slit-width or grating-constant.

At diffraction of electrons or atoms the appearance of diffraction-figure is determined by velocity (true impulse) of particles and here also the kind of diffraction object. This fact already Broglie [9] described with the attachment

$$\lambda = h / m\ v \qquad (1)$$

with λ as so called wave-length, h Planck's constant, f frequency of photons, m the mass of particle, v their velocity, c velocity of light and E the energy of photon.

For this consideration is more suitable to write divide qualities of light and matter

$$E / c = h\ f / c = m\ v \qquad (2)$$

For v = c results the known Einstein formula $E = m\ c^2$.

To be stable in movement photons must have the belonging energy to a fixed frequency. By general vortex-dynamics is known for vortex-pairs only local immediate connection between vortex-strength and frequency, the general connection between frequency and energy shall be a specific quality of the electromagnetic vortex-pair.

The electron is only stable if it has the elementary-charge and a magnetic moment of Bohr's magneton. By Nieke [10] the electron has the structure of a vortex-twin (two vortices of equal vortex-strength and equal sense of rotation which revolve round another in equal sense of rotation). In general vortex-dynamics there are not known restrictions for stability of vortices, they are to seek in electromagnetic vortex-twins.

Diffraction of electrons and atoms was discussed as wave-nature of matter. Mach [11] had already shown that diffraction and interference do not prove the wave but only the periodicity of light.

Appearances of diffraction correspond by light and electrons. Boersch [12], Hiller a. Ramberg [13] and Malange a. Gronkowski [14] showed that electrons have also diffraction-figures of half-plane and inner diffraction-fringes at the slit in short distances.

After diffraction the frequency of light is lower how Nieke [15] had shown in diffraction at small slits, but not as shifting but as spreading the line to lower frequencies. After collision of light with an electron this was known since the discovery of Compton-effect. The necessary energy causes a reduction of frequency of light and yields a velocity of electron.

That electrons after diffraction have a lower velocity is not explicit described but after scattering a reduced velocity is always reported for example by Laue [16] or Cowly [17].

IV. The self-interaction

Here (and for photons already Nieke [5]) is tried to explain diffraction with self-interaction of electron with its field.

As known Broglie [9] supposed for the photon a guidance-wave (concreter guidance-field) and Bohm [18] the split up of wave-function of elementary-particle in beam-splitting. Chew [19] caused self-interaction as 'bootstrap' able for science. There is also spoken of self-consistency and eigen-energy. Here is placed in fore-ground the term self-interaction favoured for interaction of elementary-particles with their field. Bootstrap is a too mystic expression. Crew limed his considerations on hadrons, he excluded photons because the (rest)mass nought. However, here at all photons and electrons and their relation to vortex-dynamics and self-interaction are considered.

Lorentz [20] superscribed a section (translated): „Reaction of ether on a slow moved electron of any form." Dirac [21] described the interference of photon with itself if only one photon could be found in the apparatus. That Nieke [5] used for interpretation of diffraction, where change of direction of photon with the structure of vortex-pair and eigen-field was established by vortex-dynamics in consequence of its hindered returning own field by slit or hindrance. The field is a part of photon and self-interaction is effective. By Sommerfeld [6] a vortex-pair executes with swing-deflection a change of direction if both vortices are no more exact opposite equal.

Nieke [22] showed with masking of one slit-image in an inter-mediate-image of a double-slit that after a suffice way of light (order decimetre) before intermediate-optic the diffraction-figure of the double-slit is visible. These photons have nevertheless the orientation of that slit which they did not pass. He supposed that the field of photon with structure and eigen-field, that passed the other slit, is then sufficiently returned to its photon and interfered by self-interaction.

By Hönl [23] are to find numerous hints for self-interaction (translated): „Supposed all inertia of electron is electromagnetic origin - so has one to the sum of eigen-force (the electron on themselves) ... that also the self-energy of field will be finite. ... On the other hand by Bopp-Feynman's

theory arrive principal also from all other places of backward-cone electro-dynamics effects at the place of charge. By this formulation of electro-dynamics fundamental-law is possible therefore the spreading of field-effects with any under-light-velocities. ... eigen-force of particle on itself." Hönl denoted the electron as 'pol-dipol-particle'.

V. Transfer of conception of diffraction to electrons and matter

The diffraction of light is discussed by Nieke [5] for photons with structure of vortex-pairs and hindered returning field as change of direction by vortex-dynamics. It is to try to transfer this in diffraction of electrons and matter.

Adams [24] reported about atom-optics. He wrote: „Light and atoms are governed by very similar sets of equations; therefore for almost every optical phenomena there is an atom-optical analogue."

Aharonov and Bohm [25] directed on the importance of electromagnetic fields in quantum-mechanics. Imry and Webb [26] reported about these and newer applications. Here the influence of diffraction-figure of the double-slit in electron-interferences is interesting, where part-beams run through charge tubes, influenced by a screened magnet, or run through a ring-magnet. The influence to (not only the electron but also to) the electron returning field, and with it the diffraction-figure, through electrical and magnetic fields seams self-evident with the here considerate mechanism of diffraction by self-interaction. They wrote: „The effect revealed that the phase change of a wave function must be related to some physical entity present outside a confined magnetic field."
From every electron (or atom) are starting runningly fields. That are the fields of charges and magnetic moments as the fields of structure of these particles and eventually that of nucleus. In rest or uniform velocity the field can return to the particle. This is necessary because electrons are stable particles, which are only known with elementary-charge and constant magnetic-moment; field or energy is not permitted to get lost. But if the field is hindered and can not return phase-right, so the particle executes a change of direction according to vortex-dynamics.

Duane [27] and Landé [28] directed to the importance of the structure of diffraction-object. The width of slit or grating-constant of a crystal-grating influenced the diffraction-figure reciprocally to that. So the reciprocal lattice or the Fourier-components is used. Hence X-rays and electrons yield the same reciprocal lattice but the diffraction figures have not to be complete identical. The base-diffraction determines therefore the frequency or velocity. At frequency periodicity is evident which demand the phase-right return of field. At velocity is to suppose the change of phase from start of field to its return.

At lattices the interval of lattice is so small in practice that inner diffraction-fringes are of no consideration. But also at lattices the distance of catch-up-plane has to be large, for the field which passed other parts of lattice can return to its photon or electron.

The size of field is not unconditional limited on the size of one particle but it roams also through a larger sphere. So the field used other ways as the photon or electron, other intervals from the edge, different intervals in the slit-width and in lattice or space-lattice also distant spaces of lattice. Through the return of field the photon or electron receives information of the structure of diffraction-object and executes the belonging changes of direction. Newton [1] III query 3 already inferred an eel-like movement of light-particles.

If electrons are accelerated near to velocity of light is known that the electron does obey less the acceleration. The field (as force-line) has still the previous velocity and can not return phase-right, it brakes therefore the electron. Hitherto in specific relativity-theory this was discussed as an on velocity dependent higher mass of electron.

VI. Radiation by accelerated or retarded electrons

If an electron is accelerated or retarded so the field preserves the former velocity, and the field can not return in the non-accelerated form. Here is to expect that field can not return but loosen or abscised in the way which already Hertz [29] discussed for emission of electromagnetic radiation from a dipole. To that is to respect that a photon consists by Nieke [30] as vortex-pair with two oppose rotating vortices. In two following half-periods respective such two vortices with opposite sense of rotation have to form collecting a vortex-pair which runs away with a great velocity in direction perpendicular to the line of centre of gravity of the two vortices. For electro-magnetic vortices the velocity has to be the velocity of light.

In case of bremsstrahlung by origination of X-rays where electrons accelerated by high voltage and hit with high velocity the anode. The field of these fast electrons has hitherto the high velocity and can not reach the braked electrons and field can be abscised and direct or indirect resulting in X-rays.
If electrons are kept on a circular path by a magnetic field in a synchrotron, the electrons are accelerated. The field runs on in the hitherto direction and field can no more reach its electron and is abscised. Ever so two abscised vortices of opposite rotation can form photons of synchrotron-radiation.
Cherenkov found a radiation of visible light by irradiation of fast electrons in a medium, where the velocity of electrons is greater than the phase-velocity in this medium. This light can be described as above with abscission of field which forms the photons.

VII. Inferences

In the discussion between Bohr and Einstein was considered Bohr as victor. But Einstein could prove his refuse opinion against the dualism of wave and particle (Einstein [31]: fusion of wave and particle) and indeterminism (Einstein [32]: God does not dice) to Heisenberg-Bohr's quantum-theory if he had recognise the importance of Newton's diffraction experiments. Moreover, Einstein [33] 1934 had written a foreword to Newton's optics, but the third book had obviously devoted no attention to him. Newton had not put out the observations 5 and 10 for he could not foresee Fresnel's simplifications or suppressions. Also he did not use his diffraction experiments for interpretation of nature of light. Einstein had to experiment in order to find Fresnel's inadmissible and wrong extrapolation with help of Newton's observation 5 and 10. But at that time he could not give an alternative. This was possible first about 1960 after acknowledgement of structure of elementary-particles. Already Broglie introduced with the photon with the guidance-wave, what Born corrected in guidance-field, the possibility of self-interaction (but he did not term it so). However, now it is possible to carry on the opinion of Einstein.

The optimism to this already Laue [34] had given, when he wrote (translated): „ ... For the author shines no smaller the difficulties to unit jointly particle- and wave-introductions for the same object. ... But the necessary unity of both introductions remains moreover an unrealised demand to the theory. One do not say this difficulty were invincible on principle. In an interpretation of every experiment is involved already theory.“

This theory here resulted only from suppression of Newton's diffraction experiments.

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