# 4. Particles as Planes in the Micro- and Macrocosmos

Christian Hermenau

So far, the structure of the universe has been dealt with on large scales. The development then takes place from the edge to the inside and not as in the standard model from a small punctiform area of space, about inflation, to a whole. Whenever there is a small open area at the edge of the universe, a new pair of particles\counter particle is formed in a short, equal process. The counter particle, together with the edge, moves away at the speed of light and the remaining neutron particle remains at its original position. It does not move linearly but rotates in steps and after each complete cycle gives off a space size in $U_R$-direction to the counter particle.

Between the particle and the counter particle, staked out sizes are defined that have reality for us as the only possible space step. During its rotation, the neutron occupies three space positions before the cycle repeats itself. The neutron should consist of two corresponding surfaces of size $R_e^2$, which are assigned to each other in the distance $R_e$ located and the electron and a second pair of planes of the same surface size but with a distance $d_p$. This latter plane distance depends on where it is in the universe. The radius position in relation to the size of the universe is to determine the distance between the two planes. At our position this would be $d_P = R_e m_e / m_P$. This second pair of planes then has the meaning of the proton. $d_P$ thus defines a second reference value in space, which should have reality for us in addition to $R_e$.

Proton and electron planes rotate. They point once in the $R_U$ direction and once in the opposite direction. In the two intermediate times, the plane pairs can potentially take any direction in space; it is the moment when the electron and the proton exchange with each other. In the initial state we have $n = 10^{23} s^{-1}$ connections to the antiparticle or to each other. The size $d_P$ is the smallest possible shift of the planes in relation to each other. It represents a potential energy value, which is needed to lift a ground mass particle on the universe radius by one $R_e$-step.

For a proton plane pair at our universe position, the distance would then be $d_p = 1.5 \cdot 10^{-18} m$, which in relation to the electron distance equals their mass ratios $\frac{R_e}{d_p} = \frac{M_P}{M_e} \approx 1836$.

With each $R_e$-step by which the universe enlarges, the planes of the newly formed particles that lie at the edge (the antiparticles) move away by a corresponding energy value ΔE, which is shown by the fact that the distance from $d_{mt}$ approaches the distance more and more $R_e$. $m_t$ has the meaning of an energy quantity that corresponds to the potential of the position on $R_U$.

For the distance $d_P = \frac{m_e R_l}{M_{Uo}}$ (1) apply, where $R_l$ should indicate the respective position in the universe.

At the starting time $T_U = 0$ was $R(t=0) = R_U = R_e$ and thus the plane distance was $d_0 = R_e \frac{m_e}{M_{Uo}} \approx 1 \cdot 10^{-57} m$. This tiny first plane distance $d_0$ also corresponds to the plane thicknesses $\delta$ and becomes important much later in connection with the storage of information.

At the end $T_e$ $d_P = R_e$ applies for the plane distance and we get a radius size of $R_U = \frac{M_{Uo} R_e}{m_e} = 5 \cdot 10^{27} m$ for the universe. After 540 billion years the universe would have reached its greatest extent, the development process then reverses itself.

With these new assumptions in the overall structure, an attempt is now being made to extend this to quantum mechanics. Can the proton/electron planes, which are now again to be local and temporally precisely defined quantities, be connected with the observations of reality in the microcosm and thus with quantum mechanics?

According to classical mechanics, a particle in a potential field is described by the kinetic energy $T = \frac{p^2}{2m}$ and the potential energy V(r), which together make up the total energy E: $E = \frac{p^2}{2m} + V(r)$ (2).

If the De Broglie relationship is used here for E, we get the dispersion relation $\hbar\omega = \frac{\hbar^2 k^2}{2m} + V(r)$ (3). The wavelength should be small against the typical change length of V(r).

Solutions for this equation would be a monochromatic wave of the form $\Psi = Ae^{i(\vec{k}\vec{r} - \omega t)}$ (4). This would be a complex-valued function to be assumed as a scalar function.

With $\hbar\omega\Psi = i\hbar\frac{\partial\psi}{\partial t}$ and $\frac{\hbar^2 k^2}{2m}\psi = -\frac{\hbar^2}{2m}\Delta\psi$ the well-known Schrödinger equation follows from this

$$i\hbar\frac{\partial\psi}{\partial t} = -\frac{\hbar^2}{2m}\Delta\psi + V(r)\psi \quad (5)$$

It is postulated that this equation should also apply in the quantum regime.

The Schrödinger equation is linear and homogeneous, so that usually a multitude of plane waves (4) which all fulfil the equation (5) can be combined to a wave packet $\Psi(x,t) = A(x,t)e^{i(\vec{k}_0\vec{r} - \omega t)}$ (6). An approximation for the amplitude can be given as

$$A(x,t) \approx 2A_0 \frac{\sin\left[\left(x - \left.\frac{d\omega}{dk}\right|_{k_0} t\right)\Delta k\right]}{\left(x - \left.\frac{d\omega}{dk}\right|_{k_0} t\right)} \quad (7).$$

This wave packet melts with time, but rests in a system moving at the speed $v_g = \left.\frac{d\omega}{dk}\right|_{k_{0g}}$, here the amplitude becomes time-independent.

Since we assume that protons and electrons are two indefinitely endless thin planes of area size $A_0 = r_e^2$, which have two planes of fixed size and a constant distance to each other corresponding to their respective mass, then it is no longer possible that they can be regarded as a slowly dissolving wave packet. Nevertheless, the position is further of wave-like character, which is perhaps not due to the local particle itself but is to be found in connection with other particles.

Particles do not dissolve over time, but their exact position can only be determined statistically. In order to formally

eliminate this contradiction, quantum mechanics was extended to a statistical quantum mechanics in which the exact position of the wave function is no longer determined, but its expectancy value.

Then the solution ψ, which fulfil the Schrödinger equation, are combined to a density $\rho = \psi\psi^*$ (8), which leads to the continuity equation $\rho_i + \partial_i(2\alpha\rho G_i) = 0$ (9).

For example, for a charged particle in an electromagnetic field, the corresponding continuity equation looks like this:

$$\frac{\partial\rho}{\partial t} + \mathrm{div}(\rho v) = 0 \text{ with } \rho v := J = \frac{ih}{2m}(\psi\nabla\psi^* - \psi^*\nabla\psi) - \frac{q}{m}A\psi\psi^* \quad (10)$$

J in it is now the probability current density. Analogous to the quasi-classical limit case we define than ρ as charge and current density, λ=qρ and j= qρv. From this follows the charge continuity equation: $\frac{\partial\lambda}{\partial t} + \mathrm{div} j$ with $j = \frac{ihq}{2m}(\psi\nabla\psi^* - \psi^*\nabla\psi) - \frac{q^2}{m}A\psi\psi^*$ (11)

From (9) results after the integration over the whole room: $\frac{d}{dt}\int_{i^3}\rho d^3\tau + \int_{\infty}\rho v df = 0$ (12) (for integration the Gauss sentence was used). In the quasi-classical borderline case $\int_{\infty}\rho v df$ is the particle flow in the infinite which corresponds to the preservation of the particle number in the whole, thus $\int_{i^3}\rho d^3\tau = \text{const.}$

If $\Delta V$ is a macroscopically small, but microscopically sufficiently large volume, then $\int_{\Delta v}\rho d^3\tau$ is the number of particles in Volume $\Delta V$.

In the quantum regime, however, $\int_{\Delta v}\rho d^3\tau$ can no longer be interpreted as a particle number, because even if it is constant, the wave packet dissolves over time. In addition, one-particle experiments do not show a clear connection between ρ and the particle location. It is better to give $\int_{\Delta v}\rho d^3\tau$ in the one-particle experiment than the expectancy value of the particle number in $\Delta V$. ρ thus becomes probability density

in the quantum regime and J= vρ becomes probability current density accordingly.

The sufficiently large volume $\Delta V$ can also stand for the range in which a sufficiently large number of particles are in exchange with each other.

In the now modified image of the particle, a movement only occurs step by step in whole $R_e$ or $d_p$ steps. The smallest time interval is $T_0 = 10^{-23}s$ and each exchange is to be transmitted in $R_e$ steps to $T_0$ time units. Thus a speed change in $\Delta t$ times occurs, which leaves the particle in these time intervals until a new change occurs. The connection to the homogeneously distributed particles in space is therefor of random statistical nature only, because it is immensely large. It should correspond to a three-dimensional Gaussian distribution. Then, $\varphi_0 N e^{\frac{1}{2}(k-k_0)^2 a}$ (13) represents a function that describes the expectancy value that the particle is in the $\Delta V_0$ space range. However, this location is not determined by a free independent particle, but by the corresponding contact to other particles, which exists numerically in the range of $10^{20}$ contacts/s to a correspondingly high number of particles. The respective potentials related to the mean motion have an extremely small value.

If we observe a free particle for a relatively short period of time from our macroscopic point of view, we still have to do an averaging around a space range V at the location, simply because the particle connection is so extremely high. We would have to move in the range of $10^{-20}s$ to see the particle motion and would only then observe the jump motion of a resting free particle in turn is determined by the initial conditions.

If it comes to the exchange then both particles involved should be in "line of sight" and they should be in integer distance $d_P$ to each other.

The normalization constant N of (13) results from the requirement $1 = \int dk |\varphi_0|^2 = N^2 \int dk e^{-(k-k_0)a^2} = N^2 \frac{\sqrt{\pi}}{a}$ to $N = \frac{\sqrt{a}}{\sqrt[4]{\pi}}$ (14).

The known wave function in the local space then has the following form:

$$\Psi(x,t)=\frac{N}{\sqrt{2\pi}}\int dk e^{-\frac{1}{2}(k-k_0)^2a^2}e^{i(kx-\frac{hk^2}{2m}t)}=\frac{N}{a\sqrt{1+i\frac{ht}{ma^2}}}\exp\left(-\frac{x^2-2iak_0x+i\frac{hk_0^2a^2t}{m}}{a^2\left(1+i\frac{ht}{ma^2}\right)}\right) \quad (15).$$

What is the transition from quantum mechanics to classical mechanics like? How can we convert these wave packets of the known formalism of classical mechanics to the macro range?

Therefore we start again from the principal function of classical mechanics. According to the Hamilton-Jakobie differential equation, the motion of a particle that fulfils its principal function $S=S(q,...,q_f,t)$ the equation of motion $\frac{\partial S}{\partial t}+H(q_i,\frac{\partial S}{\partial q_i},t)=0$ (16) with $H(q_i,p_i,t)$ as the Hamilton function applies to the motion. It follows for a free particle in potential V(r):

$$\frac{\partial S(r,t)}{\partial t}+\frac{[\nabla S(r,t)]^2}{2m}+V(r)=0 \quad (17).$$

After that, the properties of the principal function with respect to quantum mechanics it applies mv = p = ∇S; the particle motion thus follows perpendicular to the surfaces S=const. of the principal function.

Furthermore applies $dS=\nabla S\cdot d\vec{r}+\frac{\partial S}{\partial t}dt=\vec{p}\cdot d\vec{r}-Edt$ (18).

S should be constant, so dS = 0 and thus applies to the movement of S: $v_s=\left.\frac{ds}{dt}\right|_{S=const.}=\frac{E}{p}$. If we insert the De Broglie relation here, we get $v_s=\frac{\omega}{k}$.

These results in a relation between the movement of the phase surfaces of the plane waves and the particle movement perpendicular to the surface S, which we regard as constant.

The phase surfaces of the matter wave can be equated with the constant surfaces S of the Hamilton-Jakobi theory in the quasi-classical boundary case.

Let us now consider two free particles which are in some proximity to each other. They should be in the electric or gravitational potential field to each other. This field is now

defined more precisely by the condition that the space only gains reality in $R_e$ or $d_p$ steps and that the connection always refers to exactly two particles at a time. Then the contact in its smallest size can be described as a plane wave $\psi = Ae^{i(\vec{k}\vec{s}-\omega t)}$ which goes off in the direction of the second particle. In this smallest basic size $\omega = 2\pi\nu_0 = \frac{2\pi}{T_0}$ and $k = 2\pi\lambda = 2\pi r_e$ applies. The phase velocity of the plane wave is at $v_s$=c the surface size of the planes is limited to $A_0 = r_e^2$ (19) and only one single pulse is to go off. In addition to the phase surfaces, there are now the two surfaces of the particle, which correspond to the information about its particle mass, i.e. not the particle itself, but the information about how the space length related to the basic unit $R_e$ was compressed by the particle. If this space piece meets the second particle after a corresponding period of time, it changes the original space position in relation to the whole by exactly one space piece. In the case of a proton, for example, by exactly one $d_p$ towards the first particle. Only one whole number jump is possible at a time. Now there remains a movement of the second particle in the direction of the first particle, which takes place in $d_p$ steps on the one hand and in t units on the other. This t represents a period of time that originally required the information from the first to the second particle. The velocity of the particle is $v_T = \frac{d_p}{\Delta t}$ as long as no other contact to any particle occurs. The sequence should be valid for neutral masses as well as for charges. The decisive difference is that charges are normally limited to two particles, while masses are exchanged with an indefinite number of particles distributed throughout space.

Take, for example, a charge that is briefly excited in the atom and then spontaneously jumps back to the ground state.

In the ground state (n=1, l=0, m=0) the wave function of a one-particle system is determined by $\psi = \frac{e^{-r/r_B}}{\sqrt{\pi}(r_B)^{3/2}} e^{-iE_1 t/h}$ (20).

This results in $S=-E_1 t$ for the principal function. This means that the velocity is according to Bohm's interpretation $\dot{r} = \frac{\nabla S(r,t)}{m_e} = 0$ (21). The trajectories are areas which are distributed with a probability $|\psi|^2$ and do not really move. They rest quasi at $r=r_0$ in quantum potential. In contrast,

excited states have the form $\Psi = Y_{nlm}(r,\vartheta)e^{i(m\varphi - E_n t/h)}$ (22). Here S gets the form $S = hm\varphi - E_n t$ and then the velocity is $v = \frac{\nabla S}{\mu} = \frac{hm}{\mu r \sin\vartheta} e_\varphi$ (23) with μ as reduced mass and m as magnetic quantum number.

Trajectories in it are circles with $r=r_0$, $\vartheta=\vartheta_0$ and $\varphi = \frac{hmt}{\mu r_0^2 \sin\vartheta_0}$.

The probability density is distributed according to the sphere function $Y^2_{nlm}(r_0,\vartheta_0)$ (24).

We have determined that charges are predominantly in contact with a counter charge. So if a particle is excited from the outside, there is a corresponding distant opposite, which it aims at. The opposite should lie in the line of sight and it must not be connected to the nucleus via a corresponding wave draught, but only to the foreign charge. The disturbance of the room size in the direction of movement and the amplitude perpendicular to it moves with c towards the opposite. The location of the electron remains within the range of the two orbits. Decisive for the energy is not the deflection, but the duration, which an electron needs to come from an equilibrium state to a new one. This time period T defines the frequency and at the same speed of propagation in the vacuum, the wavelength λ. The movement of the electron shows, like the plane normal vector, at the moment of the movement away from the nucleus and at the moment of the connection to the foreign particle in its direction. For example, the Lyman-Alpha transition λ=121,6nm shows that the particle is directed to a foreign particle over a period of $t = 2 \cdot 10^{-15} s$, which seems to be short, but compared to $10^{-20} s$, the typical connection times to other particles, it is 100,000 times longer. The actual exchange with the nucleus is interrupted over a long period of time from the particle's point of view.

This seemingly so simple single oscillation is then subject to a multitude of superimposed movements at its jump, which leads to the fact that an exact localization is not possible at all. What we always see is a summary, an average of the motion and a stabilization on orbits in the atom that correspond to the expectancy value.

Thus, the pulse of a single photon causes, in comparison to the other basic quantities, a long lasting one-sided movement of the second particle; an interruption of the one-sided

electrical connection to the nucleus which represents a correspondingly much larger foreign potential.

The assumption of two fixed planes instead of one sphere, which symbolize the particles and define the space, leads to further simplifications in the micro range, which will be discussed later in more detail.