Spin and the Möbius Strip

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ABSTRACT: One has compared the spin, which changes the sign after the turn equal 360^o, with the Möbius strip - to which the perpendicular vector running round the strip changes the sense into the opposite one.
One has postulated the existence of the Möbius strip apart from loops, strings and membranes.
This model of spin has been presented as the argument for the Infeld model of the non point-like electron.
Using this conception one has explained, why the projection of spin of an electron onto a freely orientated direction of any magnetic field is constant.

The spinor turned around 360^o changes the sign into the opposite one. It turns then around 180^o.

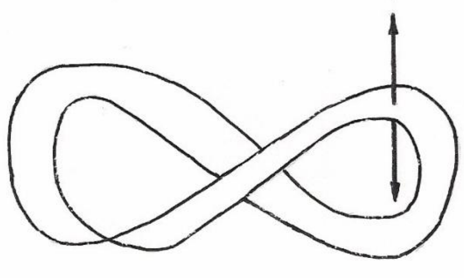

Fig. 1

Spin can be presented as the motion of the vector perpendicular to the Möbius strip along Möbius strip. At the turning 360^o, with which the motion along the whole Möbius strip to the same point corresponds, vector is placed on the opposite side of the Möbius strip with the opposite sense, as if it turned around certain axis around 180^o.

Since the string [1], the membrane [2], the bubble, or the loop [3] can be bound with the particle, so the Möbius strip can be bound with the particle too, especially with the aspect of the spin. Generally, there are n Möbius strip for the spin $\pm \frac{n}{2}$.

We have the formula implicating the Heisenberg uncertainty principle:

$$W(\varepsilon) = \int d^3r \, \left| \left(\frac{\hbar}{i} \, \partial_x - \langle p_t \rangle - i\xi x - \langle x \rangle \right) \psi \right|^2$$

But the square of module can be both positive and negative. Each particle is described by two components; this first has positive square of module and this second the negative one.

This second is the usual loop with the negative square of the module, this first is the Möbius strip insorbed in the loop. This first one (with the positive square of the module) must have the series –its width can't tend to zero.

So its twisting is possible and the shape of the Möbius strips is possible too. This second must have only the shape of the loops.

The loops is described by the formula

$$m = \alpha \, e^{i\left(\frac{2k\pi}{n} + \varphi\right)}$$

Where n may be free, but k is single for each n.

The charge is either positive or negative. The quark is b, g, or r .

So, the univocal of choice of k is in consideration of n corresponds in the case of the loop to the univocal of choice of m in the case of the Möbius strip.

Positive or negative m corresponds to two directions of helicity of the Möbius strip (see figure).

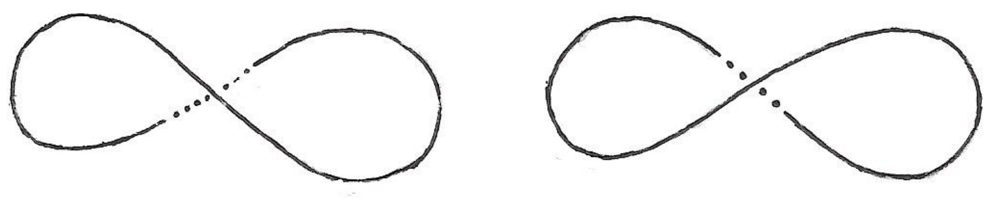

Fig. 2

Let's take under consideration the equation of field [Z. Morawski]

$$\sum_n a_n \, g^n + \sum_m \frac{b_m}{g^m} + \sum_{l \in N \cup \{0\}} c_l \underbrace{\int \dots \int}_{l} \underbrace{ln \dots ln}_{l} \; g \; \underbrace{dg \dots dg}_{l} = const.$$

Both the charges regularly placed on the circle of charge and the charges irregularly placed on this circle are solutions of this equation. (Naturally, there is

the dualism field – source (charge), because the unification of the fields must be started with the unification of the source and both fields and charges are described by the same equation.)
Spin corresponds to the regular solutions of this equation and to the irregular solution certain other charges correspond, which will be the object of further research.

The Infeld electron can be presented as a three-dimensional sphere woven from two-dimensional Möbius strips. The orientation of these strips in the sphere is accidental and an effective orientation of the Möbius strip cancels not cancelling the character of the sphere. Only an effective spin $\frac{1}{2}\hbar$ remains.
This model of an electron as the superposition of an infinite amount of all Möbius strips obtaining in the space all possible orientation explains why the projection of spin on the freely orientated axis of the vector of magnetic induction is always equal $\frac{1}{2}\hbar$.
Simply there is always a certain Möbius strip orientated parallel to the direction of magnetic induction. The magnetic field selects just this Möbius strip.
The projections of other strips are smaller and they are placed in this maximal projection of the parallel Möbius strip.
We have the formula:

$$s = \iiint \vec{m} \cdot \vec{B} \, dx \, dy \, dz = const = \frac{1}{2} \hbar$$

$\vec{m}$ - vector of the orientation of the Möbius strip
$\vec{B}$ - vector of the induction of the magnetic field.

The Möbius strip hasn't orientation, so theoretically two sub-orientations are possible:

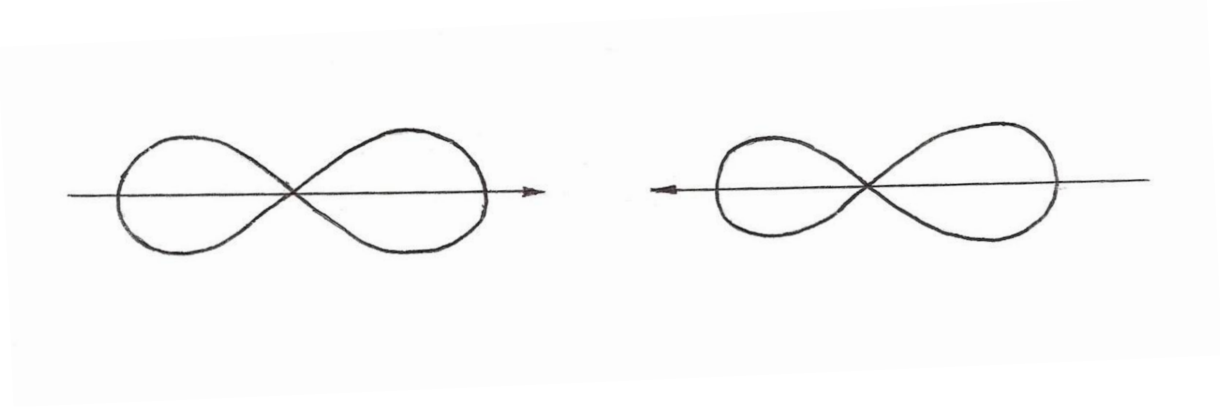

Figure 3

which corresponds to values of the integral s (it means positive and negative), and next this means two values of the projection of spin onto the axis - the direction of the vector of induction of the magnetic field.
Taking the integral s it is necessary to use constantly only one of two these sub-orientations.
The sphere may be presented as a superposition of loops with the radius equal to the radius of the sphere and such loops arise, because of the intersection of each plane containing the center of the sphere with the sphere.
Although the space is orientated, it hasn't a distinguished direction. If the loops have two the distinguished orientations, they can have two different orientations.
If we take under consideration all loops, we must take two loops in the same plane with the opposite orientations. So the total attitude of the sphere, composed of the orientations of all loops, cancels.

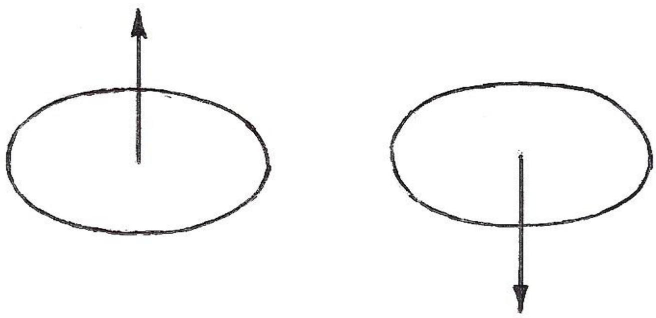

Figure 4

The sphere woven from the loops is a model of spin zero. However, the system of m Möbius strips placed linearly and sticking in the sphere and filling this sphere is a model of the spins $s = \frac{\hbar}{2} m \quad m \geq 1$.
For even m the orientation exists and spin is even. For uneven m the spin is even plus one additional Möbius strip.
The mechanism of the projection of the vector of spin on the axes of the induction of the magnetic field is the same as in the case of the single loop, but in this case the values $-\frac{m}{2} \ldots \frac{m}{2}$ are possible.
The intermediate values:

$$\frac{m}{2}\hbar, \quad \frac{m-1}{2}\hbar, \quad \ldots, \quad 0, \quad -\frac{1}{2}\hbar, \quad -1\hbar, \quad \ldots, -\frac{m-1}{2}\hbar, \quad -\frac{m}{2}\hbar$$

Appear because the vectors of spin composing the total vector of spin can have the compatible or opposite senses, what means in our model the compatible or different directions of the circulation of the Möbius strip (see figure 5).

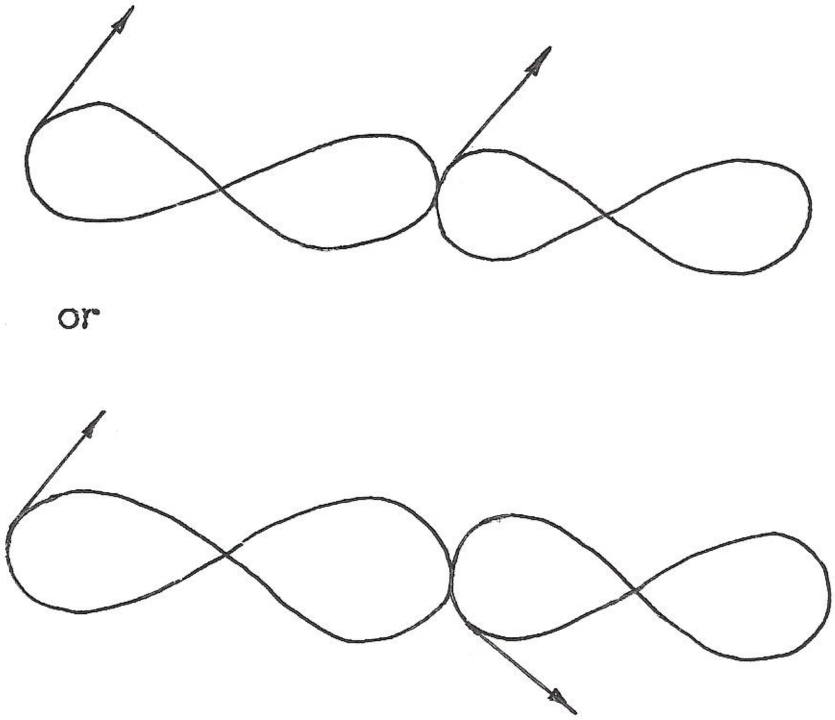

Figure 5