Spin, SpinLab & the S-Spin method.

A Visual Exploration of Spin, SpinLab software and a new method for generating spinors.

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Spin is a property of electrons, protons and neutrons. For such a fundamental property its shocking how few spin visualizations there are – and until now there have been no interactive 3D visualizers. This lack of tools to visualize and help understand spin has been a great handicap to better understanding of the fundamental properties and behaviours of spin.

Spinor - a fundamental harmonic wave.

Spi is a fundamental property of a harmonic wave of a 3D volume. Consider that in one dimension we have a single harmonic wave – the longitudinal (or compression) wave: in two dimensions we can introduce a new wave – the transverse wave: in three dimensions we can introduce the next harmonic wave – the spinor.

The spinor is a fundamental harmonic wave of a solid 3D volume. It's difficult to visualize and understand because we also exist in a 3D space – we can't look down on a 3D wave from the outside (a higher dimension) in the same way we can for 1 and 2 dimensional waves.

Why a better understanding of spin is important.

Spin is a fundamental property of the stuff that makes up ordinary matter – this is known in an abstract mathematic way but not understood in a visual and intuitive way. Until now an understanding of spin couldn't be communicated without considerable mathematical understanding… but there is more to it than that.

From years of work visualizing spinors this author finds is easy to see the intuitive obvious way in which stationary spin waves would arise naturally from the friction between two 3 dimensional spaces. In exactly the same manner that drawing a bow across a violin string results in a standing wave resonance so the friction between two 3D spaces would result in stable standing spin waves. This suggests a possible model of space time that is 8 dimensional where quantum noise (the Driac sea – Zero Point Energy) arises from friction between two 3D spaces and the resultant stable spin resonances are electrons, protons and neutrons – you can construct standing spin waves that are positive or negative (chiral) or neutral (symmetric).

This is the sort of fundamental understanding that can spring from an intuitive understanding of spin and suggests solutions to deep questions about how our universe works – offering elegant demonstrations of where mass, momentum and charge could originate from and how they may relate.

SpinLab

The SpinLab software is availble for download from www.chavascience.com/spinlab

This new application lets users visualize and manipulate spinors in a real-time 3D application. It is based on a newly invented method for generating spinors - the S-Spin method.

This new method is not only extremely simple but appears to be able to generate an extensive family of spinors that incorporates all known spinors and may well include the set of all possible spinors – something that I hope mathematically enlightened users will be able to prove, or disprove as the case may be.

It is my sincerest hope that SpinLab will provide an invaluable tool to allow everyone to understand spin and for some to advance the field and derive new knowledge and understanding from it. SpinLab is freely available and I have strived to make it open and understandable to everyone – regardless of mathematical ability. For those of you adept in the field and mathematics I hope that you find this tool valuable and we welcome your input to improving it.

In future we will add features to cover multispin interactions and to offer visualizations and results that will be used to advance related science and understanding. I have already determined how the Dirac spinors, Quaternions and the complete theory of CQD by Randal Mills sit within the extended framework of S-spinor space and we plan to include these insights in future releases.

What follows is the first explanation of a new method to generate spinors. The method was developed by Mark Snoswell in April 2011.

The S-spin method for generating spin.

A number of years ago I developed methods for generating spinors from nested librations. While it is believed that this method can generate all known spinors it has not yet lent its self to an obvious way to create arbitrarily complex spinors. In April 2011 the libration method was superseded by a new method based on similar matrices – the S-spin method. Following the discovery a modified version of the Dirac Bra-Ket notion was adopted to codify the method and this led to a simple way of generating and examining a large set of spinors. The first release of the Spin Visualizer implements the first 30 base spinors in this set with every possible variant.

A fundamental property of a spinor is that it occupies a 3 (or higher) dimensional volume and that the volume can be spinning continuously about an axis while maintaining a connection to a surrounding (and/or interior) space that is stationary – without ever tearing or tangling space. This literally means that you could take a block of foam and make an interior spherical volume of that foam rotate continuously without ever tearing or tangling the foam block. This sounds absurd and intuitively impossible at first – but it's true. The S-spin method makes this intuitively simple to understand…

Textual description:

The S-spin method involves orthogonal rotations of space. The method has three parts:

Two bracketing (Bra-Ket) rotations, on the same axis (the spin axis), that cancel each other out;

A kernel function that implements a radially decaying rotation on an orthogonal axis to the spin axis.

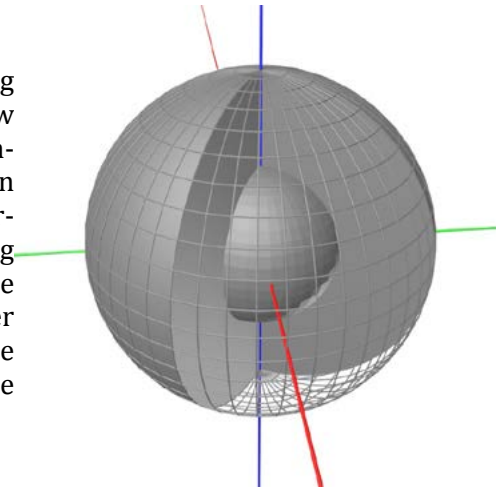
The rotation in the kernel results in the Bra-Ket functions adding up rather than cancelling out. The result is a smooth connection of stationary space to a region of rotating space where the rotating region rotates at twice the speed of the Bra-Ket function.

Diagrammatic description:

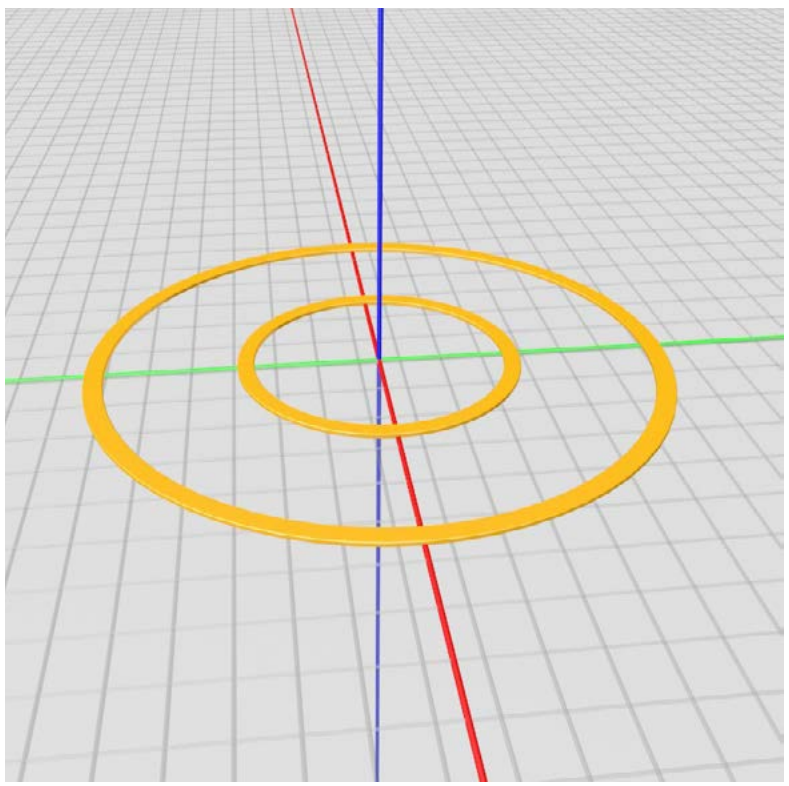
Bracketing rotations on the vertical axis cancel out = zero rotation. By flipping the central region upside down the bracketing rotations now add up = double rotation.

The smooth connection between the outer flat space and the inner flipped space ensures that there is a continuous and smooth connection between the outer stationary space and the inner spinning space.

With the following images I will show how the S-spin method creates a spinor in which the inner spherical volume is spinning continuously while connected to the outer stationary sphere. The spin axis will be the vertical blue axis.

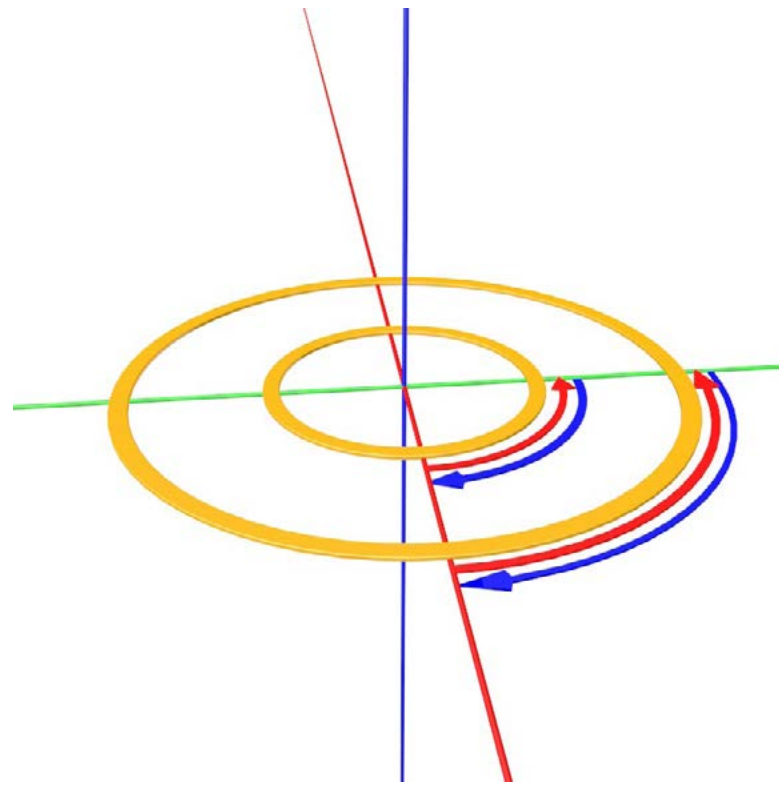


To simplify the visualization we will hide the 3D spheres and focus on the XY plane. The two orange rings represent the diameters of the two spheres in the first image.



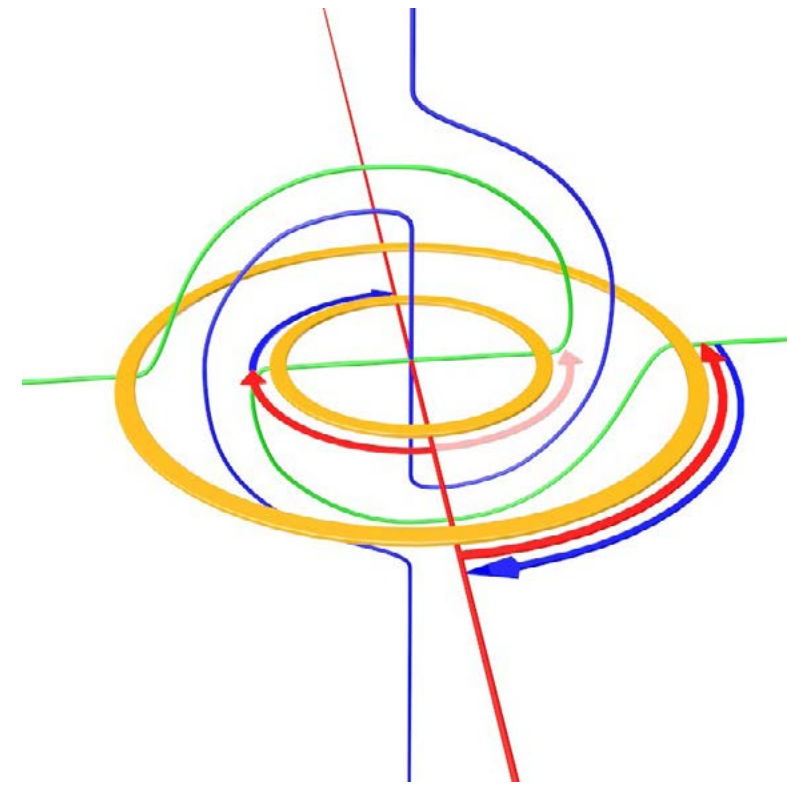
The essence of the S-spin method is the application of a kernel function that is applied between two bracketing (Bra – Ket) functions. The Bra-Ket functions are any pair (or sets) of cancelling rotations about the Spin axis (the blue Z axis). The rotations increase with time – here we show a snapshot of the simplest Bra (red) Ket (blue) rotation functions at 90 deg. The net result is a cancelation of rotation and for all time the entire volume of space remains static.

The Bra-Ket functions are implemented as orthogonal rotation matrices of the form Rz(t) and $Rz^T(t)$. Where t is time and $Rz^T(t)$ is the transpose of Rz(t) -- for orthogonal rotation matrices the transpose is equal to the inverse rotation function but is much easier to generate.

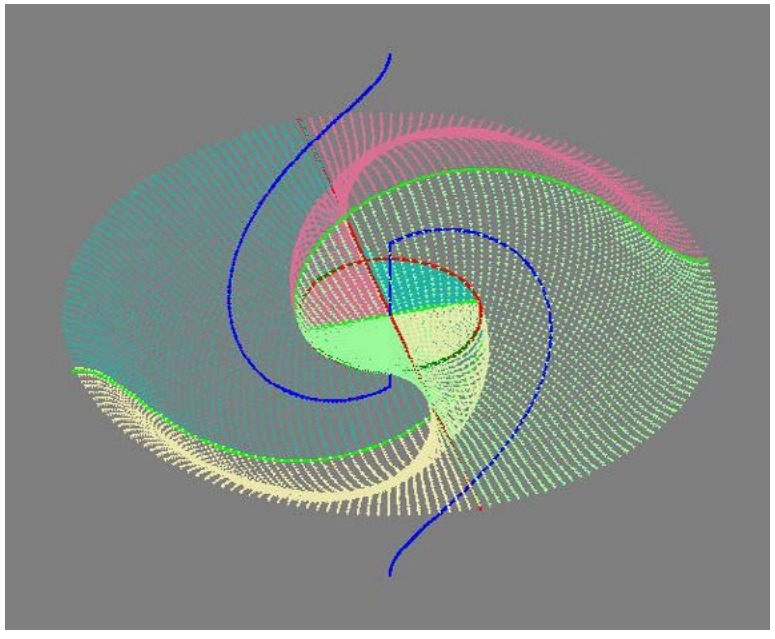


Now we introduce a Kernel function between the Bra-Ket rotations. The Kernel function is a rotation about an axis perpendicular to the spin axis. The Kernel function is static in time but decays with increasing radius. Here we see the result of a Kernel rotation of 180 deg about the red X axis. The rotation decays to zero at the outer radius… now the Bra rotation function is flipped (inner red arrows) at the inner radius before the closing Ket function is applied. The result is an addition of the Bra-Ket rotation functions at the inner radius while they still cancel out at the outer radius – with a continuous blend in-between. So from the outer radius out space is static. From the inner radius in space is spinning at twice the rate of the Bra-Ket functions. In-between the two radiuses there is a continuous smooth blend from static to rotating space.

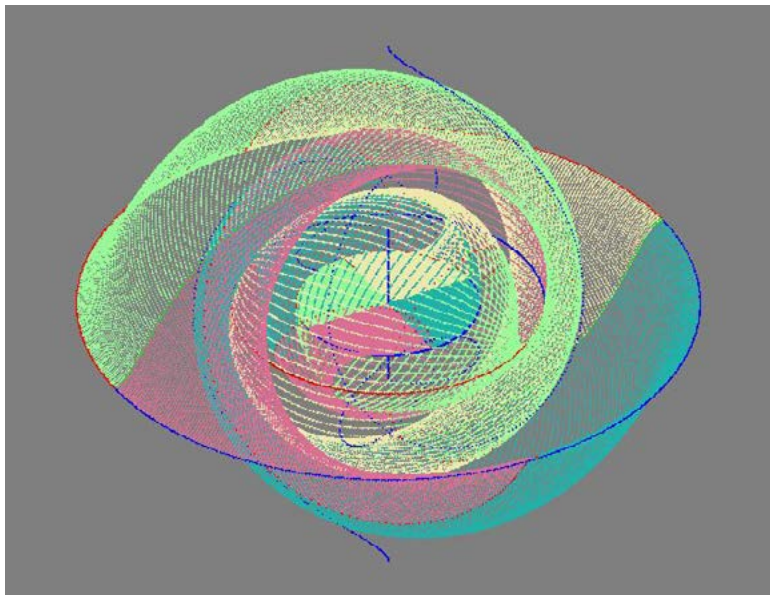
The Kernel function is implemented as an orthogonal rotation matrix of the form Rxy(1/f(r)) where f(r) is some function of the radius, r.



Here is a frame captured from the SpinVisualizer for this, the simplest, spinnor function of all. In the spin Visualiser you can see this running in real time and observe that the central space is rotating about the Z axis at twice per cycle while remaining smoothly connected to the static surrounding space.



It is possible to have any combination of Bra-Ket and kernel functions applied in any order with the following constraints – the Bra-Ket functions must all be applied to the same axis and they must cancel out. The Kernel functions must be about perpendicular axis to the Bra Ket functions. This leads to an easy method for generating spinnors of arbitrary complexity. Here is a snapshot from a more complex spinnor.



Some notes for the mathematically inclined:

Spinors are created from the product of orthogonal rotation matrices.

A modified Bra-Ket notation has been developed to describe these spinnors.

Rx, Ry and Rz are X, Y and Z orthogonal rotation matrices.

The Bra-Ket functions:

The Z axis is defined as the vertical axis and the spin axis. The Bra Ket rotations on this axis accumulate phase at a constant rate. In one period of the spinor the phase accumulation is 360 deg.

< = Z axis rotation

> = inverse of <

Therfore...

<> = >< = I the Identity.

The Kernel functions:

Rotation matrices with a winding phase, wp, that decays from a maximum at some minimum radius to zero at a maximum radius r.

x = Rx(r,wp)

y = Ry(r,wp)

a,b,c = some combination of x and y

In one period (360 deg) of the Bra-Ket functions the resulting S-Spinor acumulates by 2 revolutions (720 degrees) for every 180 deg of winding phase.

The first release of SpinLab generates all vations of the first 26 S-Spinors as defined below:

<a> (Dirac spinors)
<ab>
<a>>b< (Quaternion spinors)
<<a>>>b<
<<<a>>>>b<
<<a>b>
<<<a>>b>
<<<<a>>>b>
<a>b<c>
<a>>b<<c>
<<a>>b<c>
<a>>>b<<<c>
<<<a>>>b<c>
<<a>>>b<<c>
<a>b>c<
<<a>>b>c<
<<a>b>>c<
<<<a>>>b>c<
<<<a>b>>>c<
<<<a>>b>>c<
<a<b>c>
<a<<b>>c>
<<a<b>>c>
<a<<<b>>>c>
<<a<<b>>>c>
<<<a<b>>>c>

SpinLab also has a parser to interpret user input of spinors using the modified Bra-Ket notion.

Additions planned for future version include:

Modulation of the Bra-Ket and kernel functions with spherical harmonics. The obvious implications of this simple expansion will then encompass all of Randal Mills classical Quantum Dynamic theory -- this does not imply an endorsement of Randal Mills theories , only that they can be shown to be a simple sub-set of the full volumetric spinor space once we add the spherical harmonic modulation.

Complexification to encode the difference between pairs of S-Spinors. Obvious outcomes of this are the evolution of chirality that could be interpreted as the genesis of electrical charge – an outcome that could also arise the spherical harmonic modulation mentioned above.