Twistor particles with real spin.

Ian E. Consterdine

School House, Holwick, DL12 0NW, UK

email: i.consterdine@btinternet.com

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Abstract

Relaxing the constraint on field-theoretic wavefunctions having either integer or half-integer spin yields an alternate route into the dark sector revealed under observations of galactic rotation rates and accelerating universal expansion. Recent developments and this continuation predict a fraction of self-interacting dark matter comprises elements with irrational (e.g. $2^{-1/2}$) spin.

1 Introduction

The origins of twistor theory by Professor Sir Roger Penrose[1] gives details on the developing algebraic language used to describe the theory. A public talk on the youtube: http://www.youtube.com/watch?v=hAWyex1GKRU makes the ideas clear to a wider audience.

George Musser[2] wrote a recent review article in Scientific American magazine to show twistor/string theory remains a useful continuation.

The twistor particle programme published hitherto[3] includes examples from 2 spin classes (fermion, boson and in units where h = c = 8πG = 1): lepton/neutrino/quark: spin 1/2 = $2^{-1} = {}_2i^2 = {}_2e^{i\pi}$ and higgs/photon/gluon/graviton: spin 0, 2^0, 2^1. All standard model particles have such spins. Yet, the scope of available spin classes triangulated by Andrew Kels[4] is Cardinal and spin is a measurable property in/of space-time (Martens & de Muynck[5]).

The simplest supersymmetric models predict dark sector elements where fermion and boson spins are swapped (s-fermions have spin 0 whilst s-bosons are spin 1/2). Consequently, the “Standard Model” becomes merely half the story. Andrew Kels' solution to the “star triangle relation” allows an alternate proposal to increase the number of available spin classes. Basically, shedding light on dark matter has great theoretical scope.

2 Select irrational

Which, if any, of the unobserved-hitherto spinning, Kelsian realnesses will interest physicists for a while? Or, how does one make a rational selection?

Discussions with David Falconer[6] and Phil Jones[7] suggest the next, "totally tautological and qualitative" (Falconer, personal communication) real numbers beyond the standard model and supersymmetry are given rationally by the irrational, positive square-root of 2

$= \sqrt{2} = 2^{1/2} = {}_2 2^{-1}$ and its reciprocal $1/\sqrt{2} = 2^{1/2}/2 = {}_2 2^{-1}.2^{-1}$. Scalar products on quaternion matrices exchange helicity.

These rottons – named for the infinite precision required to specify their spin - are distinct from both Weinstein spin 3/2 (e.g. M. du Sautoy[8]) and other generic trions[9]. Rottons appear from the projective nature of twistor geometry, if and only if this view from the back-wood-side-line-hill-sides isn't just $2^{\text{Fiat Lux}}$

A plane right triangle (Figure 1) of unit height and base has hypoteneuse ± $2^{1/2} = {}_2 2^{-1}$

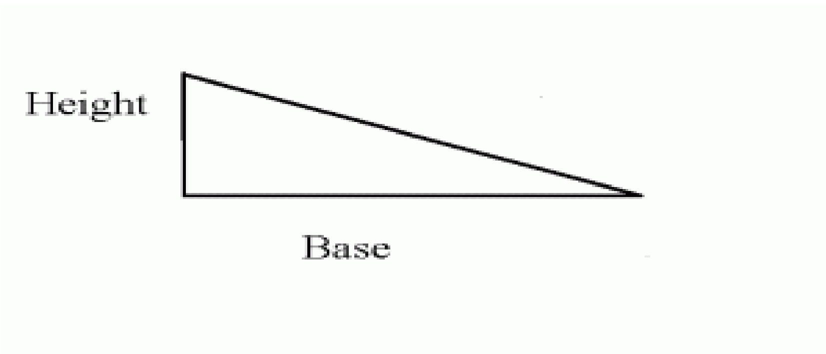


Figure 1: Plane right triangle

Projected rotton spin values $2^{1/2}$ ("boson-like") and $2^{1/2}/2$ ("fermion-like", 2 copies, projected < or >, tangentially over a 2-sphere of radius $2^{1/2}/2$) follow “positive Grassmanian permutation” and holomorphism.

The boson-like rotton $_{2}2^{-1}$ transforms into twistor space T as a flag-plane pointer on the unit Riemann sphere, but sadly, i don't have the mathematical sophistication to describe "inside a Riemann sphere". Paul Nylander[10] and Frank Jones[11], however, seem to have some of the necessary ideas and wit. Further and greater imagination than mine alone is required to project the insides of a stringy meatball, sausage-sectionally etc...

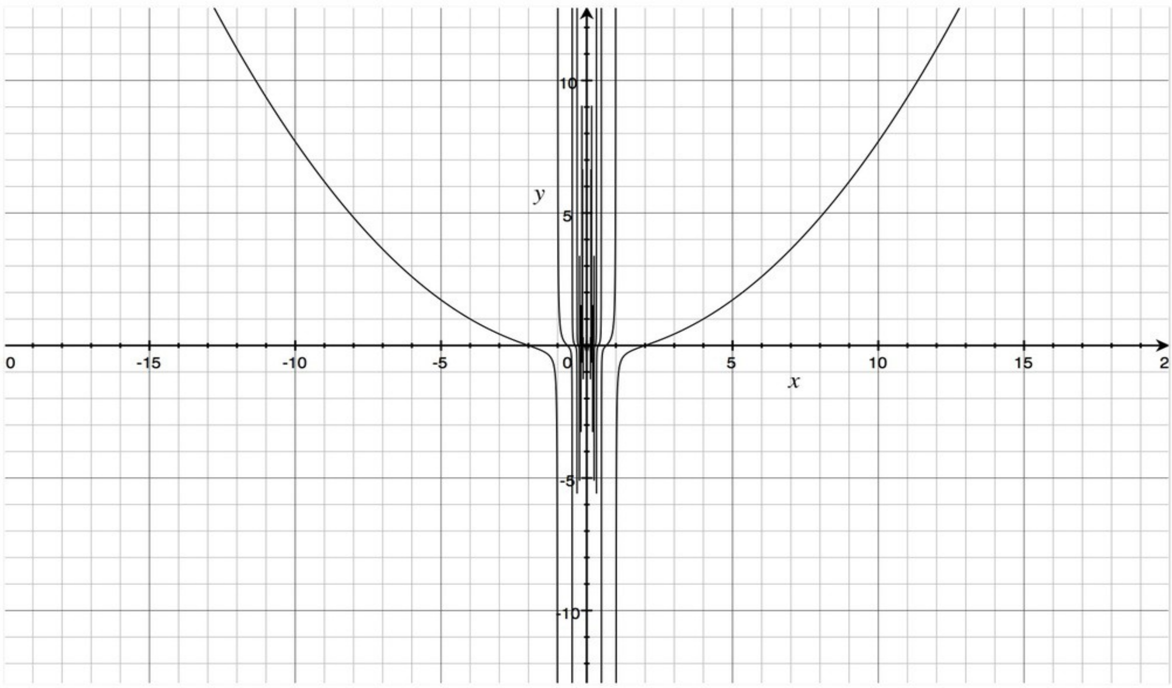
It is conceivable but probably unlikely that these rottons are massless and contribute only Weyl curvature (see e.g. R. Penrose, 2004[12]) to the metric. Nevertheless, a suitable $U(1)_{dark}$ will suffice to describe their dynamics.

Next, the plane right triangle of unit height and hypoteneuse 2 has base $\pm 3^{1/2} = {}_{3}2^{-1}$

Hey, prongo! 8-off rottons with spin $\pm 3^{1/2}$ (boson-like), $\pm 2.3^{1/2}/3$ (quark-like), $\pm 3^{1/2}/2$ (fermion-like) and $\pm 3^{1/2}/3$ (quark-like) project, again holomorphically. Any “exochemistry” resulting from short range interactions between the elements and/or compounds of these 3-ons and Lisa Randall et al[13] Double Disk Dark Matter emerges, naturally.

There exists a compound object which already displays one of these spins in nature. The electrically neutral hydrogen atom has a total spin angular momentum identical[14] with $3^{1/2}/2$.

Figure 2: $y = x\,Cot(^{\pi}/x)/4$ for $-13 < x < 13$



The unit pentagon yields two further pairs of "Golden ratio" rottons, namely $\pm(1 + \sqrt{5})/2$ and $\pm|(1 - \sqrt{5})/2|$, whilst the heptagon and prime n-agons beyond yield spin magnitude $n/4 \cot {}^{\pi}/n$. The analytic function $y = x/4 \cot {}^{\pi}/x$ over a small range of x is plotted as Figure 2. The function has poles at $x = 2^{-m}$ for integer m. In the spirit of this enquiry, a pole where m is prime is a candidate nottor (inverse rotton).

3 Experiment

Rottons and nottors are measured physically how, when and where? Other than by their gravitational fluence, I do not know. I'd probably start at femtoscale engineering of temperature, distance, [unit]...

Path integrals (QED-like Feynman diagrams) for the boson-like: ${}_{2}2^{-1}$ <-> $[\,{}_{2}2^{-1}/2]_{<} + [\,{}_{2}2^{-1}/2]_{>}$.

4 Conclusions

Quantum mechanical spin is just another number. In physical momentum space it is observed as a result of transformations of holomorphic forms of entangled 2-component, complex numbers (spinors).

References

1. Roger Penrose, 1987 : http://users.ox.ac.uk/~tweb/00001/

2. George Musser, 2010 : http://www.scientificamerican.com/article.cfm?id=simple-twist-of-fate

3. Edward Witten, 2004 : http://arxiv.org/abs/hep-th/0312171/

4. Andrew P. Kels, 2013 : http://arxiv.org/pdf/1302.3025.pdf

5. Hans Martens and Willem M. de Muynck, 1994 : http://www.phys.tue.nl/ktn/Wim/bohrfopl1.pdf

6. e.g. http://www.saatchigallery.com/artists/david_falconer_articles.htm

7. http://www.rationalskepticism.org/physics/twistor-string-theory-t18197.html

8. http://www.guardian.co.uk/science/2013/may/23/eric-weinstein-answer-physics-problems

9. http://en.wikipedia.org/wiki/Trion_(physics).

10. Paul Nylander, 2005 : http://nylander.wordpress.com/2005/05/19/loxodromes-on-riemann-sphere/

11. Frank Jones, 2005 : http://www.owlnet.rice.edu/%7Efjones/loxo.html

12. Roger Penrose, 2004, “The Road To Reality”, Oxford Univ. Press

13. Double Disk Dark Matter : http://arxiv.org/pdf/1303.1521v1.pdf

14. http://en.wikipedia.org/wiki/Spin_quantum_number

15. Nima Arkani Hamed *et al*, 2013: