ZULF EXAMINES ISSUES OF ZONAL HARMONICS ON S^4

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The most important functions in the entire universe are no longer secret. There is also no controversy regarding why they are important.

We are of course speaking of zonal harmonics of the four-sphere S^4. These are so beautiful I feel like hugging them and kissing them and making an altar and a monument to worship them and sing songs to them and venerate them.

You will be wondering whether Zulfikar Moinuddin Ahmed, once a sane and reasonable young man at Princeton University between 1991-1995 has finally lost all sanity altogether. Or you might be one of these cantankerous fucks who dare to think that some other functions are more important in the universe, provoking a religious war.

Years ago, in 2008, long before my worship of zonal harmonics began, I might have even sympathised with you. I might have looked with suspicion at anyone who worships and venerates zonal harmonics. I might have even mistaken such a man as that *red stapler afficionado in Office Space*. But not today. You see in 2008 my convictions regarding four-sphere theory were based on spectral theorem on four-sphere being responsible for quantisation of energy alone. It took quite a few years to learn something *magnificent, and marvelous*. And this is that some of the eigenfunctions of the Laplacian on all n-spheres have *point localisation*. These are the zonal harmonics.

You see we do not really gain intuition about spherical harmonics. We look at Fourier series on the circle, trigonometric functions all, and without even thinking gain the prejudice that spherical harmonics are like them.

Well you will not even understand my happiness when I learned that for each $k = 0, 1, 2, 3, \dots$ on the four-sphere S^4 there is a very very special spherical harmonic, a lovely and beautiful spherical harmonic called the *zonal harmonic*. And it has the property that it achieves its maximum at the north pole.

And for the truly *magnificent and remarkable and lovely property* it is actually *localised near the north pole*. Isn't that the most beautiful thing you have ever heard? It was heavenly music to my ears!

Let's rewind a little bit. You see we live in this universe, and we find that all sorts of things are *particles* or *corpuscles* or what have you. Their existence is quite *totally mysterious* and sages and priests and physicists of the past ten million years were completely mystified by this. They were so mystified they attempted no explanation for this. This all changed until I, Zulfikar Moinuddin Ahmed, for the first time in human history, gave the first explanation.

Let me finish my story. Fine fine, you know the answer. It's the zonal harmonics, they are localised. That's the answer!

The properties of zonal harmonics of S^n were known to Mehler in 1866 but they are still quite obscure. I was looking over the McGill Master's Thesis of a gentleman

Date: January 26, 2022.

named Joel Tousignant-Barnes from 2011, and I liked what he was doing in Chapter 3 of his work, and he was careful and scholarly so I decided to just use some of it to continue my story.

I did not do original work on zonal harmonics at all. I was interested in my four-sphere theory for macroscopic nature, and I discovered the centrality of zonal harmonics some years ago, I do not recall when exactly, but sometime between 2012-2018.

The most important thing about zonal harmonics is that they are localised at the north pole of S^n. We are only interested in $n = 4$.

The k-th zonal harmonic $Z_k(\theta)$ is

$$Z_k(\theta) = C(k)P^(1,1)_k(\cos\theta)$$

where

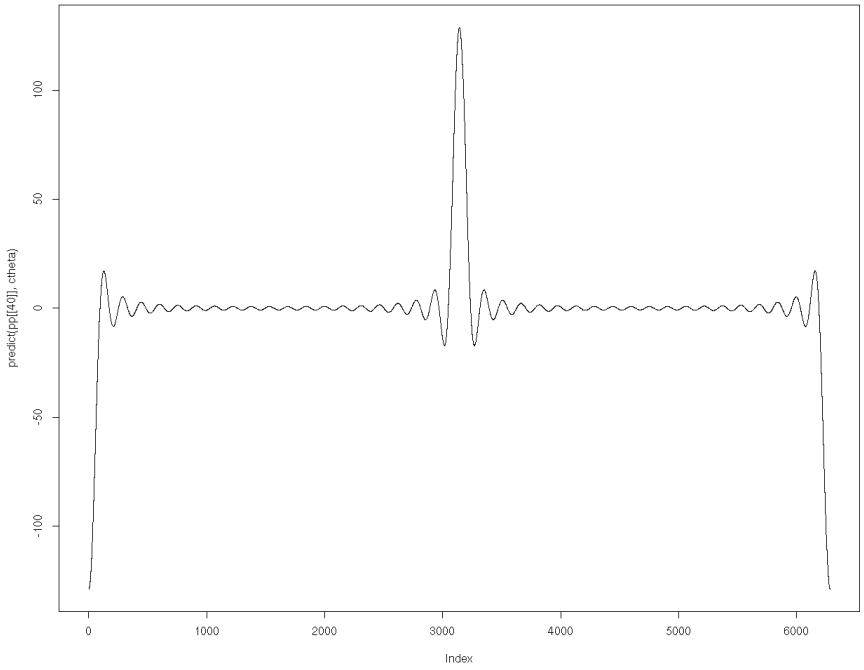
$$C(k) = \frac{2k+3}{3}\frac{\Gamma(k+3)}{\Gamma(3)\Gamma(k+2)}$$

and $P_k^{(a,b)}$ are the Jacobi polynomials. Mr. Tousignant-Barnes does some L^p computations for these zonal harmonics in his Master's Thesis [1].

Our great achievement regarding these is not mathematical at all. It is to identify these zonal harmonics of S^4 as the source of particle localisation in our four-sphere theory that is naturally determined by the geometry of the scaled four-sphere, and not introduced by ad hoc theories such as solitons and others. This allowed us to resolve wave-particle duality issues in nature without any effort.

You see the radius of the universe is $R = 3075.69Mpc$, something finite and precise, not small but not infinite. This is a crucial discovery about the universe by myself. Now the energy levels at which visible spectrum photons occur or electrons occur corresponds to $Z_k(\theta)$ with k quite high and I won't estimate how high. These harmonics are in Dirac eigenspinors in four-sphere theory quite naturally and this allows us to gain some sense for the sort of localisation just by scalar functions.

Let me now do a simple exercise to illustrate what the localisation looks like. We are not attempting to produce any complicated computations. We are interested in just making sense of what sort of localisation our four-sphere theory guarantees.



That's $Z_{100}(\cos(theta))$. For actual physics, $k = 100$ is extremely low but you see the beautiful localisation here? That's the source of all particles in Nature.

And if anyone asks you, "Who was the first man in the entire human history who truly found the deep source of localisation of all particles?" You should not hesitate to answer, "Well, it was Zulfikar Moinuddin Ahmed, the Asian-American man."

References

[1] Joel Tousignant-Barnes, Concentration Of Laplace Eigenfunctions, Masters, McGill 2011