

Reflections on the spin-statistics theorem

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Abstract. This poem was inspired by George Sudarshan's work.

Spin-statistics is a monumental mystery
That determines microscopic possibility.
 No one could explain it,
 No one understood it,
Not, of course, til Sudarshan and me.

This law holds true just perfectly
Unspoiled by atomic instability.
 Our only explanation?
 Just pure postulation!
Except, of course, for Sudarshan and me.

Oh, all the best scored brilliantly
From Pauli to Wightman to infinity.
 But their proofs are so abstruse
 They are of very little us.
Not use, of course, by Sudarshan and me.

Proofs appear quite frequently
But all are flawed essentially.
 Take two electrons ... we are told
But then such proofs unfold.
Not that, of course, of Sudarshan and me.

The common error we see
Takes exchange physically:
 Two-particle translation
 Followed by rotation.
Not done, of course, by Sudarshan and me.

The problem here, quite basically,
Is equating states identically
Which are only equivalent
With phase indeterminant.
Not us, of course, nor Sudarshan and me.

The fatal error is the plea:
Take two electrons ... not three?
Canonical quantum mechanics
Contains no such handy tricks.
Not use, of course, by Sudarshan and me.

Operators like L and P
Transport electrons symmetrically.
So to rotate just two
You really can't do.
Nor done, of course, by Sudarshan and me.

Our proof is simplicity
But does require facility
With second quantization-
Exit the whole population!
Not you, of course, nor Sudarshan and me.

We need a bit of relativity,
A Hamiltonian and field hermiticity,
Symmetry of the mass matrix,
And a couple of other tricks.
Made clear, of course, by Sudarshan and me.

At the end, it's rewarding to see
Just how very blessed are we
Who study this quantum jewel.
We understand Pauli's rule!
With thanks, of course, to Sudarshan and me.

But many still do not agree
That our proof is error free
Or even sensible,
Let alone comprehensible.
Ever thus, bless us Lord, Sudarshan and me.

References

- [1] Sudarshan E C G 1968 *The Fundamental Theorem on the Connection Between Spin and Statistics*, in proceedings of the Nobel Symposium 8, N. Swarthholm, ed. (Almqvist and Wiksell, Stockholm)
- [2] Ian Duck and Sudarshan E C G 1998 *Toward an Understanding of the Spin-Statistics Theorem*, Am. J. Phys. 66, 4, pp. 284-302
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