ThreadSky

A Bluesky thread, unrolled

Nereide
@drnereide.bsky.social

Physicist interested in Astrophysics and Particle Physics| Research in Math and Science Edu| Math and Science Writer| Teacher and Teacher Trainer

My blog: https://www.tutto-scienze.org/

More about me: https://www.linkedin.com/in/annarita-ruberto-3970507/

4,465 Posts **5,797** Followers **61** Following

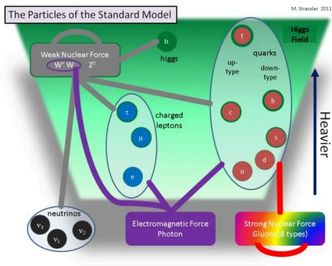
1/12
John Baez et al. have just published a paper linking decades-old #mathematics to a new way of thinking about quantum mechanics. 🔭🧪⚛️

The result?

The Standard Model (SM) of particles seems to emerge naturally from certain mathematical structures.

Here's a simple explanation, I hope.

#physics



2/12
Let's start simple.

The SM describes the tiniest known particles & the forces acting on them, respectively quarks (inside protons and neutrons), leptons (like electrons & neutrinos), and 3 forces— electromagnetic, weak, and strong.

3/12
Its main symmetry (the gauge group) rules act like hidden rotation or transformation instructions for particles.

They tell us how particles can be changed while the laws of physics remain exactly the same.

4/12
In ordinary quantum mechanics (QM), the things we measure (observables)— like position, energy or spin — are described by Hermitian matrices.
These are special tables of numbers designed so that measurement results always come out real.

5/12
In the 1930s, people invented "Jordan algebras" precisely to formalize these observables.

There is an exceptional version involving octonions (8-dimensional numbers that are strange and non-associative, unlike ordinary numbers).

6/12
Baez and colleagues use a generalization called "hermitian Jordan triples" (mathematical structures with a three-element product, more flexible than the classical algebras).

7/12
In the "bi-Cayley" version (based on octonions with complex numbers added, like a richer version of basic octonions), by choosing two special "pure states" (the simplest possible quantum states, like basic building blocks) inside this structure, the symmetry group reduces to that of the SM.

8/12
This also means the mathematical space naturally splits into exactly the right pieces that match one generation of quarks and leptons (the particles in the Standard Model).

In short: you start from this abstract structure and the symmetries plus particles appear "for free".

9/12
It's like discovering that an old mathematical toy already contained the blueprint of our particle universe.

Metaphor: it's a bit like finding the Lego instructions already inside the bricks.

10/12
Clear limits: the paper shows only an elegant correspondence for symmetries and particles (the "kinematics").

It does not explain masses, full interactions, or include gravity.

11/12
It is not a new ready-to-use physical theory, but a promising new mathematical starting point.

Nice for those who like seeing how deep #mathematics and #physics touch.

12/12
End of thread. Hope it's clear!

If you have questions about any part, just ask.

And here is the paper: arxiv.org/abs/2607.10833

Jordan Pair Quantum Theory and the Standard Model

Jordan pairs and hermitian Jordan triples were discovered by mathematicians studying Jordan algebras, which describe the possible algebras of observables in quantum mechanics. We point out...

arxiv.org/abs/2607.10833

Read John Baez post: bsky.app/profile/john...

#⚛️🔭🧪 #physics #mathematics

> **John C. Baez**
> @johncarlosbaez.bsky.social
>
> The math has been around for decades - but nobody noticed it gives a new framework for quantum mechanics from which the Standard Model gauge group and its representation on one generation of quarks and leptons falls out pretty naturally.
>
> arxiv.org/abs/2607.10833