



NEWS ABOUT SYMMETRIES IN PHYSICS

ISCMNS 12th Workshop

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Let there be light! Said the Lord



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And the light was!



In the beginning of humankind there was...



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The cave!



As all thermodynamicists know, the cave is cold... (14°C)



And man was looking for excess heat!



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He found wood!



And could get fire!





Excess Heat!

Other trials were made over the centuries to get excess heat out of wood...



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Some non-conventional!



And it was sometimes pretty hot!



Alternatives were attempted over time...



But a breakthrough occurred with wood during the second world war...





And sometimes it was very hot!...



Some trials of replication were attempted...



We tried ourselves and made it hot... 😊



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But no Kind of Global Bake
could bring us to “Industrial Heat” 😊



So, we decided to come back to the basics...

WOOD!

But 21st century wood!



PIERRE CURIE'S THEOREM

- The characteristic symmetry of a phenomenon is the maximal symmetry consistent with the existence of the phenomenon. A phenomenon can exist in a medium which possesses its characteristic symmetry or the one of one of the inter-groups of its characteristic symmetry. Otherwise said, some elements of symmetry can coexist with some phenomena, but they are not necessary. What is necessary is that some elements of symmetry do not exist.
It is the dissymmetry which creates the phenomenon.
- We announced at SSICCF20 in Xiamen that symmetry means disorder while dissymmetry means order
- We are going to show how to prove that and shall draw the consequences of this



WHAT IS A SYMMETRIC FIGURE

- Let E be any set of points in a geometric space G and let us call $O(G)$ the group of isometries of G . Then we shall say that E is a symmetric figure if there exists a non-trivial group of isometries of G , $O'(G)$ such that for all isometry f in $O'(G)$, $f(E)=E$.
- Remark
 - If the isometry is positive this means isotropy and homogeneity of the universe, which we are used to
 - If the isometry is negative, this means independence of the property vis-à-vis the orientation which is a rare property in physics (e.g. violation of parity in quantum physics)
 - Because the magnetic field is a pseudo vector, we cannot have the latter when it is present



DISTINGUISHABILITY PRINCIPLE

- *Let us consider we are in G . We would want to distinguish points in this space. Our only means are going to be the most natural possible functions which preserve space on a finite range. We mean isometries. Why do we not consider other functions like homothetic transformations for example? The reason why is simple: we want to know, in G , if we can distinguish sets of points. For this, we must not “alter” G . Indeed, what would mean intrinsic distinguishing if we can alter the space we are in? Now, how can we operate to distinguish sets of points with isometries? The most obvious way is to use the only property we have in our space and which is distance. We propose the following definition.*



DISTINGUISHABILITY

- Two sets E and F are indistinguishable if whatever any arbitrary order on E , say, $<$, there exists a non-trivial group of isometries of G such that for all the isometries of this group we have $f(E)=F$ and $(E,<)=(F,<)$.
- Just please notice that if, for a given point P in E , we consider $D=\{d(P,M), M \text{ in } E\}$, then $D'=\{d(f(P),f(M)), M \text{ in } E\} = D$ with exactly the same order
- This clearly shows that isometries cannot allow distinguishing the same set before and after the application of the isometry since we have $(D,<)=(D',<)$
- Now, if we refer to modern cryptography, indistinguishability is the root condition for disorder, hence a symmetric set is in maximum disorder
- Please notice that the notion of order is relative to the isometries at stake



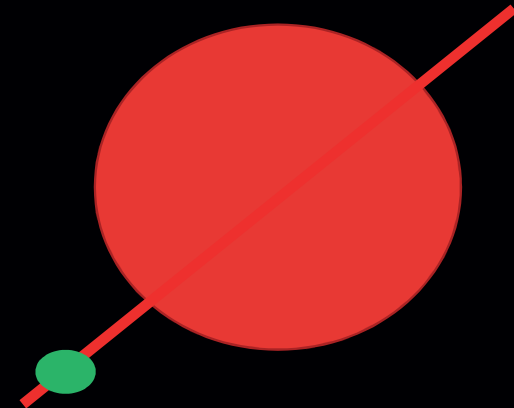
WHAT IS A POINT OF VIEW?

- For any set E of points of G and any point P of G not necessarily in E , we say that E is symmetric viewed from P if there exists a non-trivial group of isometries of G , $O'(G)$, such that $f(\{P\} \cup E) = \{P\} \cup E$ for all isometry f in this group
- Given what we said earlier, this implies that we have maximum disorder in $\{P\} \cup E$ because of the indistinguishability property
- Theorem
 - Any symmetric set, viewed from any inside point, has maximum disorder.
- What about the square viewed from the outside?



THE STRANGE CASE OF THE SPHERE

- Theorem
 - Whatever the dimension of G a sphere is always symmetric viewed from the outside
- Theorem
 - Let us consider any set of points (at least 2) $E \subseteq \mathcal{G}$ such that E is not a sphere and has in its group of invariants at least a reflection. Then E is dissymmetric viewed from the outside.



CAN WE HAVE THE CONTRARY

- In the figure hereunder, we have a symmetric from the outside and dissymmetric from the inside configuration



APPLICATION TO PHYSICS

- A system is going to evolve from dissymmetry to symmetry
- This is consistent with thermodynamics
- Every time there is any phenomenon (e.g. gravitation, electromagnetic force, etc.), this means that there is a dissymmetry
- Dissymmetry in our model is the only source of events!
- Symmetry is synonymous of stability
- As a consequence
 - A particle (say an electron) must be symmetric viewed from the inside (stable) and dissymmetric from the outside (Coulomb force)



SOME MORE CONSIDERATIONS

- Our universe is stable, hence must be symmetric from the inside (it could evolve, the case being, from a dissymmetric state to a symmetric one)
- The underlying order within our universe, is linked, say, to the elementary particles which it consists in together with the fields
- This means that the entities constituting the elementary particles or even the points of space creating the fields must be dissymmetric viewed from the outside while being symmetric viewed from the inside
- Philosophically, this means that the source of order in our universe comes from islands of total disorder according to our theory
- Another consequence is that elementary particles must have components



SOME MORE CONSIDERATIONS

- Any isolated system is characterized by its Hamiltonian

$$H(p_1, \dots, p_n, q_1, \dots, q_n) = cte = E$$

- This equation defines a hypersurface in the space of phases
- If this hypersurface is symmetric, then we have maximum disorder in it
- To this maximum disorder, by Shannon's information theory we cannot match any information in the "true world"
- This means that a symmetric hypersurface corresponds to a state of maximal entropy

THE LEAST ACTION PRINCIPLE

- As a basic, we go from dissymmetry towards symmetry
- However, when there is a split, say a neutron into an electron + a proton (forget the antineutrino), the least action principle we propose is the conservation of what we call the “degree of dissymmetry”.
- The neutron is unstable. Now at the very moment it splits, the couple electron + proton is dissymmetric viewed from the outside and we say, in some way, that there must be continuity in the symmetrization of the system
- The achievement of physical symmetry is reached through distance. However, how can it be since we based our notion of symmetry on the notion of isometry?

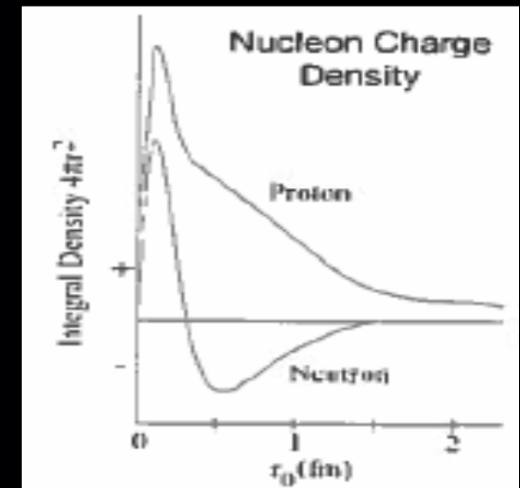


TRYING TO SOLVE THE PARADOX

- It is pretty obvious that we tend to symmetry when the relative distances tend to infinite
- This therefore suggest a dissymmetry degree law varying in $1/r^\alpha, \alpha > 0$
- The problem is to how to deal with the case $r \rightarrow 0$ since this gives a potential infinite value
- If we come back to the neutron decay, then this would mean that the internal degree of dissymmetry within the neutron is infinite
- First of all, it is known that the neutron must have components because of its internal distribution of charge

TRYING TO SOLVE THE PARADOX

- Let us remember that mass and charge are extensive magnitudes
- If we consider any sequence of subsets of the neutron volume decreasing to zero $V_n = V_0 / 2^n$ then when we converge towards 0, we do not converge into vacuum according to Einstein's general theory of relativity, but to a point where there is a field!
- This means that the limit of the sequence of volumes cannot be zero *physically*.
- We simply propose, as we did already many times, to consider a non-Archimedean universe which perfectly fits with both the convergence to a punctual field and to an infinite degree of dissymmetry



WHAT ABOUT ATTRACTION?

- The preceding model seems not to work in the case of gravitation since symmetry would be reached when the bodies are in contact with each other and would plead to have a symmetric state when the distance tends to 0
- We suggest to keep the same law for the degree of dissymmetry as before, that is $1/r^\alpha, \alpha > 0$
- We explain the equilibrium through a symmetry which is going to involve, say, the contact forces between 2 bodies. These symmetries are to be considered in addition to the only one giving rise to the gravitational field

WORKING IN A 4D SPACE

- We can generalize our approach to a 4D space including time
- A symmetry then and in an obvious and very general way, will involve motion and motion very naturally becomes a condition of equilibrium and stability
- Every time we want to change any “natural” (i.e. equilibrium) motion then we fight against stability, hence the reaction or resistance of the system
- Just please notice that at low speeds because of the principle of inertia, rectilinear uniform motion does not perturb stability. But it does, thank to special relativity at great speeds! And we expect the laws of relativity (special and general) being a consequence of the created dissymmetry!



THERMODYNAMICS

- Since we have justified the non-Archimedean character of our space this implies the “right” to use the surreal numbers
- As a consequence of this, we can prove that all of the 4 principles of thermodynamics can be applied in the open system we call our universe
- We also proved at SSICCF20 that the details of the proof bring to a potentially new kind of thermodynamics between $\mathbb{R}[1/\omega]$ and $\mathbb{R}[1/\sqrt{\omega}]$



Thank you for your attention