A brief note on the magnecule order parameter upgrade hypothesis

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Abstract. In this short remark, we report on recent hypothetical work that aims to equip Santilli's magnecule model with topological deformation *order parameters* (OP) of fractional statistics to define a preliminary set of wave-packet wave-functions for the electron toroidal polarizations. The primary objective is to increase the representational precision and predictive accuracy of the magnecule model by exemplifying the fluidic characteristics for direct industrial application. In particular, the OPs are deployed to encode the spontaneous superfluidic gauge symmetry breaking (which may be restored at the iso-topic level) and correlated with Leggett's superfluid B phases to establish a *long range* constraint for the wave-functions. These new, developing, theoretical results may be significant because the OP configuration arms us with an extra degree of freedom for encoding a magnecule's states and transitions, which may reveal further insight into the underlying physical mechanisms and features associated with these state-of-the-art magnecular bonds.

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In recent works [1, 2, 3, 4, 5, 6, 7, 8], R.M. Santilli discovered a new type of atomic force field for a stable, magnetic-based bond, namely a *magnecular bond*, that binds together stable clusters of atoms into *magnecules*—a magnecular bond is different than the bonds of conventional chemistry. More precisely, a magnecule [1, 2, 3, 4, 5, 6, 7, 8] is defined as a cluster of individual atoms and/or molecules bonded together by the opposing magnetic polarities of [9]: 1. *electron orbital toroidal polarizations*, 2. *electron spin polarizations*, and 3. *nuclear spin polarizations*.

At this point in time, the realm of magnecules [1, 2, 3, 4, 5, 6, 7, 8, 9] remains largely unexplored, unconquered, and untapped because magnecules are a completely new chemical species. Thus, in contrast to conventional molecules, relatively little is known about the application potential of magnecules, including the underlying physical mechanisms of their characteristic magnecular bonds and electron toroidal polarizations. However, magnecules have already been experimentally-verified in the laboratory [1, 2, 3, 4, 5, 6, 7, 8, 9] and implemented at the industrial level to create clean, cost-efficient, sustainable, power sources such as *MagneGas fuel* (from recycled liquid waste) [10, 11, 12, 13] and *Intermediate Controlled Nuclear Synthesis* (ICNS) [3, 14, 15, 16, 17]. A groundbreaking feature of both MagneGas [10, 11, 12, 13] and ICNS [3, 14, 15, 16, 17] is that neither emits harmful waste and/or radiation—a decisive outcome that favors the general protection of the planet. In part, this is due to the fact that magnecular bonds are generally weaker than conventional chemical bonds so synthesis and combustion thresholds exist at relatively low energies [1, 2, 3, 4, 5, 6, 7, 8]. Hence, it is possible to synthesize "hybrid beasts" or "anomalous species" with *both* molecular and magnecular bonds [1, 2, 3, 4, 5, 6, 7, 8]. Therefore, such magnetic-based atomic force fields do exist in nature and impose physically-measurable effects so it is important to continue to rigorously subject magnecules [1, 2, 3, 4, 5, 6, 7, 8, 9] to the scientific method in order to expand and advance their applications in the disciplines of computation, physics, chemistry, biology, medicine, neuro-science, and engineering, etc.

In this brief note, we probe this frontier by highlighting one particular facet of recent work [9] aimed at the advancement of magnecules [1, 2, 3, 4, 5, 6, 7, 8, 9], where the following conjecture is proposed [9]:

> ***Hypothesis:*** *the model of magnecules (including magnecular combustion and synthesis) [1, 2, 3, 4, 5, 6, 7, 8] may be upgraded with topological deformation OPs of fractional statistics [9, 18] to encode spontaneous superfluidic gauge symmetry breaking (which may be restored at the iso-topic level [19] because the exact reconstruction allows the precise identification of the iso-unit [20, 21, 22, 23, 24] that carries all symmetry-breaking terms), correlated polarization helices with long range order, and wave-packet wave-functions.*

In Ref. [9], the author systematically explores the said hypothesis with a step-by-step procedure that gives a preliminary equipment of OPs [18] to the geometry and topology of a relatively simple magnecule case [1, 2, 3, 4, 5, 6, 7, 8].

Initially, for this magnecule "base case" [9], there are the dual, individual, identical protium atoms H^1 and H^2

that are inter-locked with the magnecular bond $H^1 \times H^2$ from Refs. [8, 9]—see Figure 1 [9]. Next, in the magnecule OP upgrade procedure hypothesis [9], the geometry and topology of $H^1 \times H^2$ [8] are established, where H^1 lies on the "top" complex plane $X_1 \subset Y$ and H^2 lies on the "bottom" complex plane $X_2 \subset Y$ in the 3D space Y, such that $e_1 \subset E_1 \subset X_1$ is H^1's electron location in the uppermost topological electron orbit $E_1 \subset X_1$, $p_1 \subset X_1$ is H^1's proton-center-of-mass location, $e_2 \subset E_2 \subset X_2$ is H^2's electron location in the lowermost topological electron orbit $E_2 \subset X_2$, and H^2's proton-center-of-mass location at $p_2 \subset H^2$ [9]—see Figure 2 [9]. Subsequently, $H^1 \times H^2$'s toroidal polarizations [1, 2, 3, 4, 5, 6, 7, 8] of Figures 1–2 are replaced with the toroidal polarization *helices* of Figure 3 [9] because a layer of OPs [18, 25] is applied to the geometry and topology of $H^1 \times H^2$ [8] to encode topological deformations of fractional statistics [18] for the states and transitions of the electron orbits at E_1 and E_2. The said hypothesis and work [9] aims to initiate a more precise representation of the fluidic structure of $H^1 \times H^2$ [8] and the spontaneously generated toroidal polarization helices of E_1 and E_2 (that acquire geometric phases) by introducing an additional degree of freedom, where three distinct *complex-valued* OPs [18, 25] are introduced [9]:

1. the ***orbital angular momentum OP*** ψ_L, where $|\psi_L| \in [0,\infty)$ is the amplitude-radius and $\langle\psi_L\rangle \in [0,2\pi]$ is the azimuthal-phase [9];
2. the ***spin angular momentum OP*** ψ_S, where $|\psi_S| \in [0,\infty)$ is the amplitude-radius and $\langle\psi_S\rangle \in [0,2\pi]$ is the azimuthal-phase [9]; and
3. the ***total angular momentum OP*** ψ_J for the spin-orbit coupling $\psi_J = \psi_L + \psi_S$, where $|\psi_J| \in [0,\infty)$ is the amplitude-radius and $\langle\psi_J\rangle \in [0,2\pi]$ is the azimuthal-phase [9], such that ψ_J is identical to the "B_{SO}-vector" in Ref. [26].

More precisely, the ψ_L, ψ_S, and ψ_J OPs are introduced [9] to encode the spontaneous superfluidic gauge symmetry breaking (which may be restored at the iso-topic level [19]) for the inter-connected, magnetic alignments and electric toroidal polarization helices of $H_1 \times H_2$ [8], where ψ_S and ψ_L are *orthogonal* and "Cooper paired" for the well known electric-magnetic symmetry so the phase between them is always *constant* and serves as a wave-function constraint [9]: ψ_S and ψ_L exhibit *long range order* and are orthogonally-correlated with *Leggett's superfluid B phase* [18, 25] and spin-orbit coupling [18, 26] so they can simply be added together to yield ψ_J [9]. For this, ψ_L, ψ_S, and ψ_J are assigned to key locations of $H^1 \times H^2$ [8] at $e_1, p_1 \in X_1$ and $e_2, p_2 \in X_2$ to identify and define a conjecture [9] that aims to further characterize $H^1 \times H^2$'s underlying physical mechanisms and inter-locking alignments [8, 9] to achieve a theoretical increase in precision that is intended for direct industrial application (i.e. MagneGas [10, 11, 12, 13] and ICNS [14, 15, 3, 16, 17, 3]). Thereafter, it is hypothesized that *H^1's full electron toroidal polarization helix wave-packet wave-function* may be defined (in *preliminary* complex form) as [9]

$$H^1 : \ \Psi_{total}(e_1) \equiv \Psi(e_1) \equiv \psi_J(e_1) \times e_1 \tag{1}$$

from eq. (1) of Ref. [9] and similarly *H^2's full electron toroidal polarization helix wave-packet wave-function* may be defined as [9]

$$H^2 : \ \Psi_{total}(e_2) \equiv \Psi(e_2) \equiv \psi_J(e_2) \times e_2 \tag{2}$$

from eq. (2) in Ref. [9]. Here, the proposed wave-functions of eqs. (1–2) comprise the underlying ψ_L and ψ_S OPs, which are orthogonally-constrained by Leggett's superfluid B phase [9, 18, 25] and spin-orbit coupling [18, 26]. It has been theorized that a more advanced electro-magnetic manipulation of eqs. (1–2) in the laboratory could permit one to synthesize more complex magnecular-based structures for improved energy utilization [9]. Thus, we suggest that future work should further assess the physical legitimacy and features of eqs. (1–2) with a thorough consideration of other possible wave-function constraints. Additionally, it may also be beneficial to assess the feasibility of replacing the 2D/complex-valued representation of eqs. (1–2) with a 3D/triplex-valued representation (i.e. modified 3D spherical coordinate-vectors with addition and multiplication) [27, 28], but further work must be done on this to rigorously define and apply such a 3D coordinate-vector algebra that complies with the maximum load of numeric field axioms.

So this brings us to the conclusion of this extended abstract. In our opinion, Santilli's magnecules [1, 2, 3, 4, 5, 6, 7, 8] are fascinating, cutting-edge creatures that exist in a relatively unexplored, unconquered, and untapped domain with a potentially limitless application to science, technology, engineering, and medicine. The experimental-validation of magnecules and their characteristic magnecular bond [1, 2, 3, 4, 5, 6, 7, 8] has already paved the way for striking industrial innovations such as the clean, sustainable, cost-efficient, safe energy sources like MagneGas [10, 11, 12, 13] and ICNS [3, 14, 15, 3, 16, 17]. Therefore, it is essential to further subject magnecules [1, 2, 3, 4, 5, 6, 7, 8] to the scientific method by asking questions, proposing hypotheses, and conducting experiments. Hence, in this brief note we highlighted the key aspects of the magnecule OP upgrade hypothesis presented in Ref. [9] with the objective to

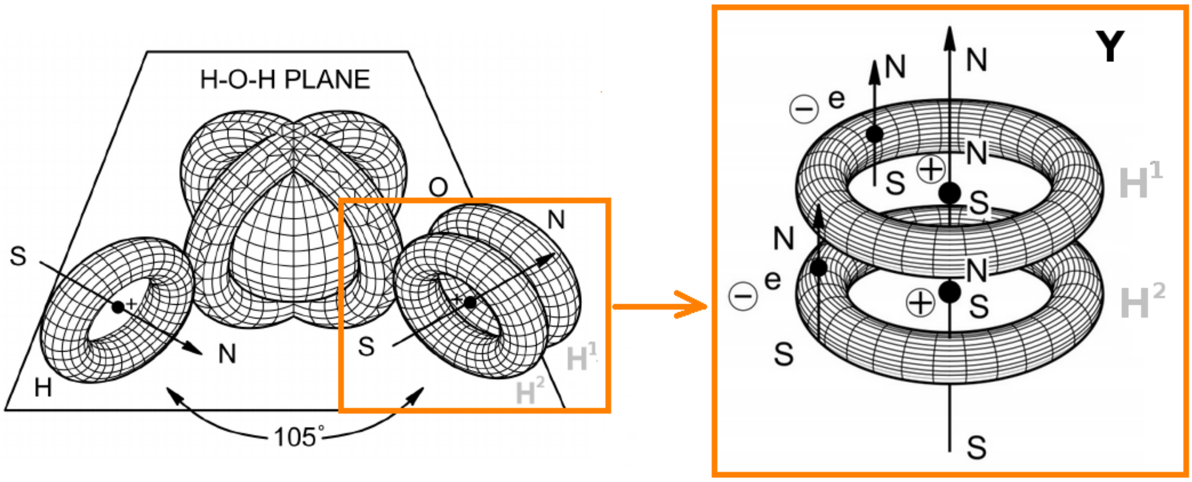

FIGURE 1. The dual, individual, identical protium atoms H^1 and H^2 in a magnecule [1, 2, 3, 4, 5, 6, 7] are inter-locked with the magnecular bond $H^1 \times H^2$ [8, 9]. This illustrates the dominance of the attraction due to the opposing magnetic polarities of the electron orbital toroidal polarizations, the electron spin polarizations, and the nuclear spin polarizations over the repulsions due to opposing charges, such that H^1 and H^2 are assumed to have a null total charge [1, 2, 3, 4, 5, 6, 7, 8, 9].

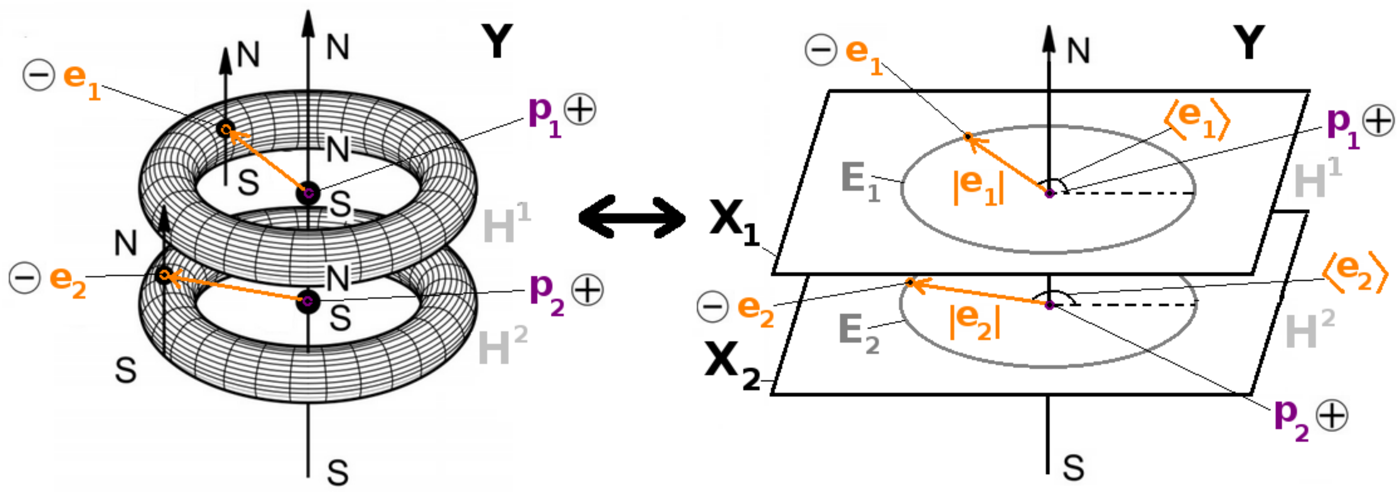

FIGURE 2. The two distinct 2D spaces $X_1 \subset Y$ and $X_2 \subset Y$ contain the encoded complex locations for the dual nucleic center-of-masses ($p_1 \in X_1$ and $p_2 \in X_2$) and the dual electrons ($e_1 \in E_1 \subset X_1$ and $e_2 \in E_2 \subset X_2$) for the $H_1 \times H_2$ magnecular bond [8, 9] in the 3D space Y [9], where $E_1 \subset X_1$ and $E_2 \subset X_2$ are iso-metrically embedded topological 1-spheres (with equivalent electron radii) that encode the electron orbits [9].

spark additional scrutiny, advancement, and innovation. These preliminary outcomes [9] support the said hypothesis, where the described OP equipment appears to extend the magnecule model [1, 2, 3, 4, 5, 6, 7, 8] with an extra degree of freedom to further exemplify the fluidic structure and underlying physical mechanisms of the magnecular bond. Therefore, near-future steps should be to give this preliminary upgrade [9] a more rigorous mathematical treatment and experimentally assess such results [9] in the laboratory.

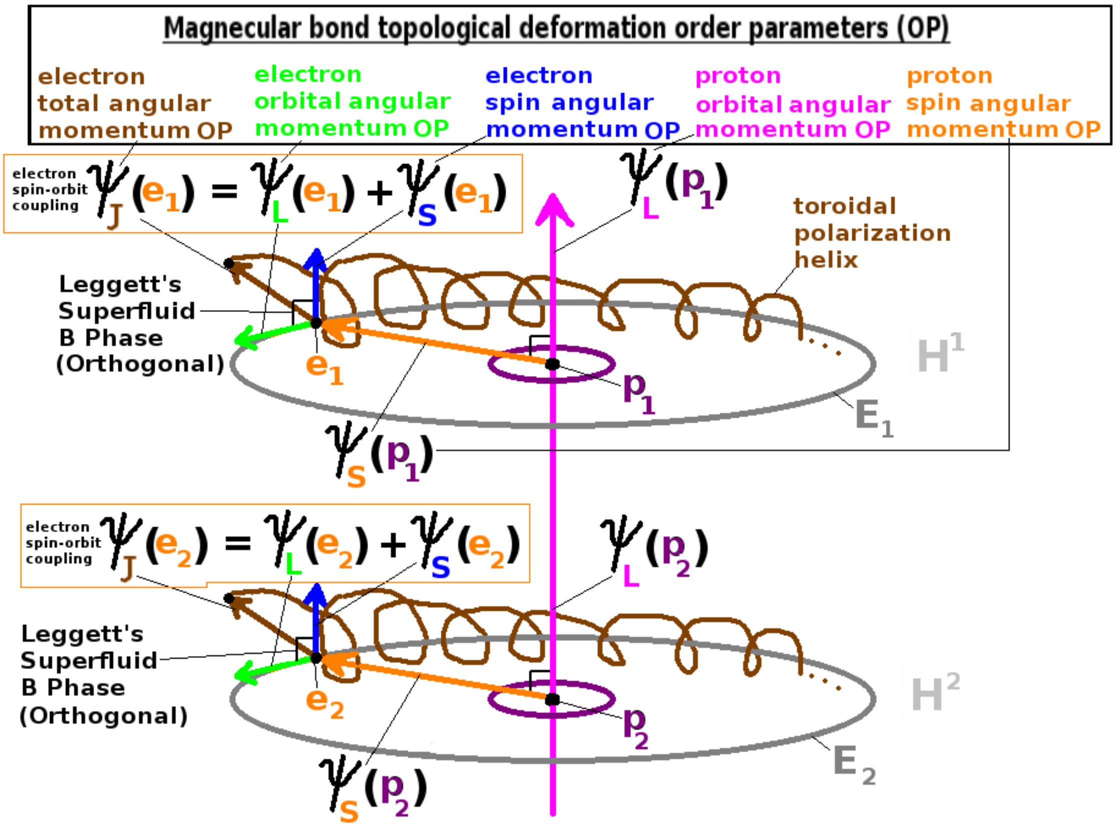

FIGURE 3. The individual, identical, dual protium atoms H^1 and H^2 of the $H^1 \times H^2$ magnecular bond [8] are equipped with the topological deformation OPs [9] that implement the spin-orbit coupling [26] for the inter-locking of the electrons and nuclei, which are orthogonally-correlated with Leggett's superfluid B phases [18, 25] and spin-orbit coupling [26] for Santilli's magnecule model [1, 2, 3, 4, 5, 6, 7, 8].

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