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EXPERIMENTAL DETECTIONS OF $\mathbf{H_3O}$, COH, $\mathbf{CO_2H}$ AND OTHER ANOMALOUS SPECIES

Ruggero Maria Santilli
Institute for Basic Research,
35246 US 19 N, No. 215. Palm Harbor, FL 34684, U.S.A.
Email: basicresearch@i-b-r.org

Abstract

In this note, we present apparently for the first time, the experimental detection at three different analytic laboratories, via the use of three different gas chromatographic equipment, of stable species with 19, 29, 45, and other anomalous *a.m.u.*; among various alternatives, we tentatively interpret them as due to the new species $H_3O = H - O - H \times H$, $COH = O - C \times H$, $CO_2H = O - O - C \times H =$ where $-$ denotes the valence bond and $\times$ denotes the magnecular bond; we point out expected implications for the structure of liquids; and offer at no cost samples of the anomalous gas containing the new species to qualified colleagues for independent verifications.

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KEY WORDS: valence bonds, magnecular bonds, magnecules

In preceding works (see Ref. [1] with preceding literature), the author presented physical and chemical evidence suggesting the possible existence of a new chemical species consisting of *clusters of individual atoms (H, O, C, etc.), dimers (HO, CH, etc.) and ordinary molecules (H_2, CO, H_2O, etc.) bonded together by attractive forces between opposing magnetic polarities of toroidal polarizations of atomic orbitals, as well as the polarization of the magnetic moments of nuclei and electrons* (see Fig. 1).

The new species was submitted under the name of *magnecules* (or also *magnecular clusters*) in order to differentiate them from the conventional *molecules,* where the latter is referred to clusters of atoms solely solely under the conventional valence bond, while the former is referred to mixtures of molecular and magnecular bonds. Valence bonds are hereon represented with the symbol $-$, while magnecular bonds are represented with the symbol $\times$.

The existence of magnecules was originally established, via the use of a Gas Chromatographic Mass Spectrometer equipped with an InfraRed Detectors (GC-MS/IRD), to exists in the combustible gas produced and sold under the commercial name of MagneGas^{TM}, whose magnecular structure originates from the synthesis of the gas via a submerged electric arc (see www.magnegas.com for details).

Subsequently, the author developed in 2003 [2] a new chemical species of Hydrogen denoted MH which is 98% pure Hydrogen, yet its specific weight is a multiple that of conventional molecular $H2 = H - H$. Since the Hydrogen has only one valence electron and since

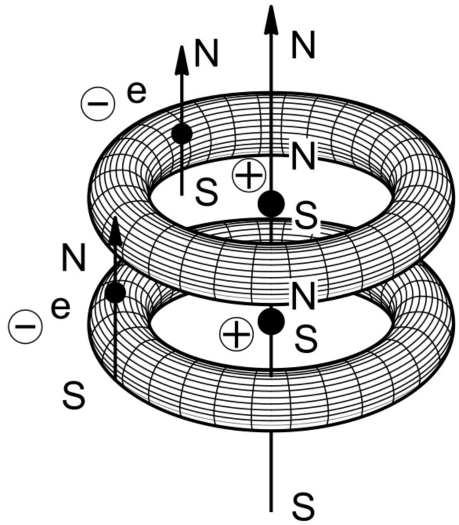

Figure 1: *Conceptual rendering of an "elementary (two-body) magnecule" at absolute zero degree temperature illustrating the dominance of the attraction due to magnetic polarizations of electron orbitals, nuclei and electrons over the repulsions due to opposing charges, since the atoms herein considered are assumed to have a null total charge.*

valence electrons bond in singlet pair with null spin that, as such, cannot bond to another valence electron due to its spin 1/2, as well as for other reasons, the new species MH can be best interpreted as being constituted by magnecular species of the type

$$MH_2 = \{H - H,\ H \times H\}, \tag{1a}$$

$$MH_3 = \{H - H \times H,\ \ H \times H \times H\}, \tag{1b}$$

$$MH_4 = \{H - H \times H - H,\ \ H \times H \times H \times H\}, \tag{1c}$$

and so on.

The new species MH was first independently verified by D. Day in 2011 [3], it has been subjected to comprehensive experimental verifications in 2012 [3] and it is currently in industrial production and sale (see, e.g., www.magnegas.com).

the existence of the new species of Santilli magnecules has been subjected to systematic studies in ref. [5] of 2013. An independent review of the underlying discipline is provided by Ref. [6] of 2003 and a general review of the mathematical, physical and chemical profiles is provided by monograph [7] of 2011.

In this note, we present, apparently for the first time, the experimental detection at three different analytic laboratories, via the use of three different gas chromatographic equipment, of stable species with

$$19,\ 29,\ 45`a.m.u. \tag{2}$$

and other anomalous $a.m.u.$ values. and their tentative interpretation as being characterized by magnecular clusters.

In the top of Fig. 2, we present a scan obtained on November 2, 2009, by the FAI Analytic Laboratories in Atlanta, Georgia, on Magnegas via a contemporary GC-MS operated at 10 C column temperature, showing the detection of anomalous species with molecular weight 92). In view of the magnecular structure of the originating gas, we tentatively present here the following interpretation of the new species

$$H_3O = H - O - H \times H, \ or \ H - (O \times H) - H, \tag{3a}$$

$$COH = C - O \times H, \ or \ O - C \times H, \tag{3b}$$

$$CO_2H = C - O - C \times H, \ or \ C - (O\times) - H. \tag{3c}$$

The above interpretation is based on the verification obtained on the same tests by FAI of the *anomalous accretion* by MagneGas clusters of one individual Hydrogen atom, a property existing from few $a.m.u.$, all the way to hundreds of $a.m.u.$ illustrated in the representative scan at the bottom of Fig. 2. It should be noted that such an anomalous accretion occurs for a gas whose heaviest molecule should be CO_2, a feature illustrating the very selection by the author of the name "MagneGas."

Following the above measurements, the author searched for years for a laboratory interested in the independent verification or denial of anomalous species (2). Unfortunately, no laboratory cooperated with the author's requests in the operation of GC-MS necessary for the detection of magnecules [1]. For instance, analysts would insist in using the GC-MS according to procedures fully established for the detection of molecular species (e.g., by using high column temperatures, short elusion times, etc.), thus resulting in the apparent dismissal of new species (2). These difficulties explains the lapse of time between the date of the original detection of new species (3) and the date of their presentation in this note.

Finally, in early 2010 the author became aware of the intention by HyFuels Corporation in Tarpon Springs, Florida, to have an older GC-MS/IRD be restored by a specialized company in the field, and elected to wait for the availability of that instrument due to its superior capability of two independent detections on the same injection, that via the GC-MS and that via the IRD (see Refs. [1,2,3] for brevity).

Finally, the desired GC-MS/IRD arrived in mid 2012 by comprising a HP GC model 5890, a HP MS model 5972, and a HP IRD model 5965 equipped with a HP Utra 2 column 25 m long, 0.32 !mm ID, and film thickness of 0.52 um, with temperatures starting at 10^0C for 4 min, then raising to 250^0 C at $10^0C/min$.

When properly operated for the detection of magnecules (e.g., by using the lowest available column temperature, the longest available elusion time, the largest available cryogenically cooled feeding line, etc. [1]), the latter instrument did confirm the magnecular structure of MagneGas [5] as consisting of clusters fully identified in the GC-MS, but possessing no IR signature at the $a.m.u.$ of the clusters (and not at the $a.m.u.$ of the constituents), as shown in representative scans of Fig. 3.

In Fig. 4, we present the second experimental evidence obtained on October 9, 2012, via the above identified GC-MS/IRD confirming the existence of the anomalous species at $19, 29, 45$ and other $a.m.u.$ in magnecular clusters that have no IR signature at their $a.m.u.$.

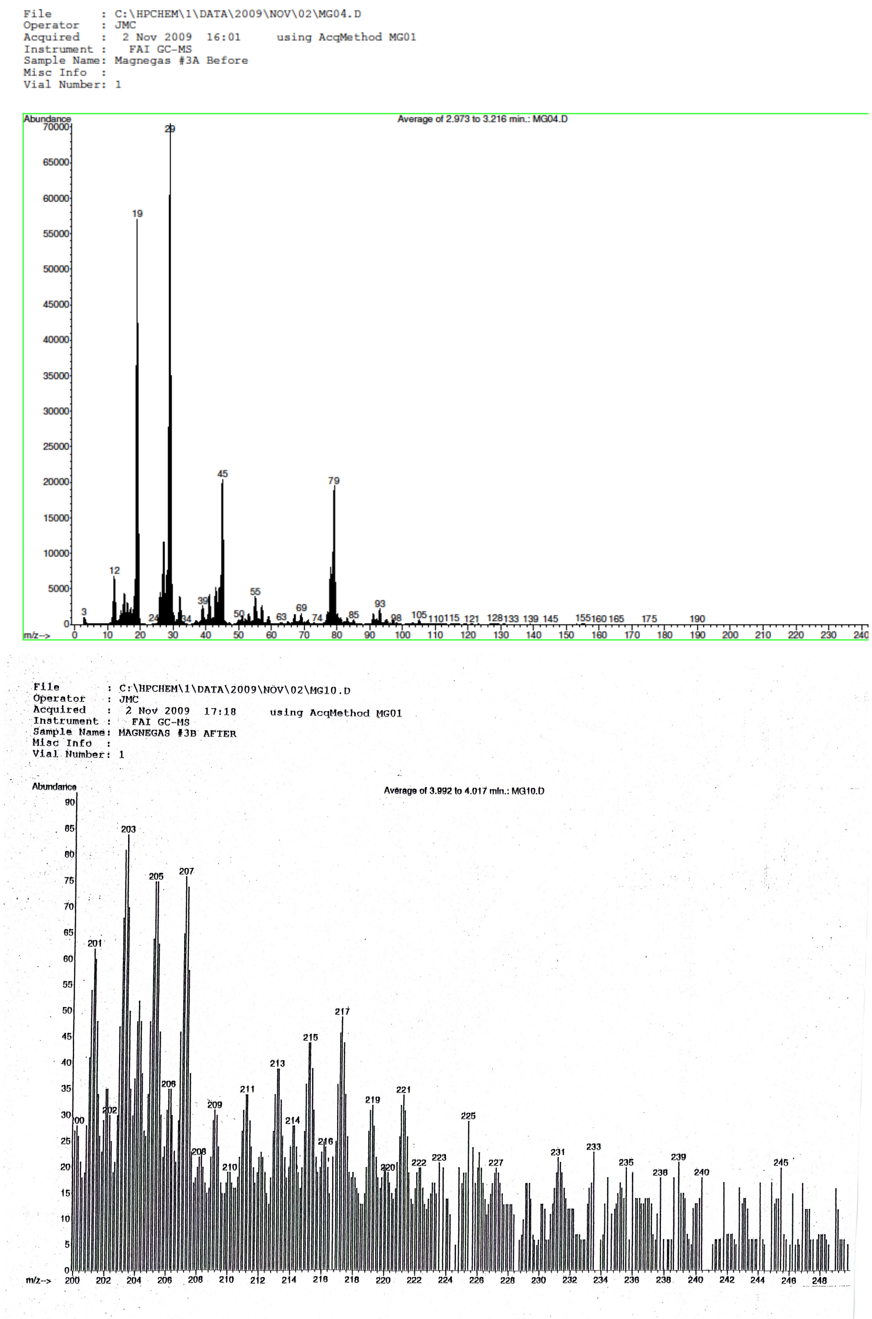

Figure 2: *The top view shows a representative scan obtained on November 2, 2009, by the FAI Analytic Laboratories of Atlanta, Georgia, on the gaseous fuel MagneGas via a contemporary GC-MS operated at low column temperature, showing anomalous species with (2). The lower view shows the anomalous accretion of MagneGas clusters by one single Hydrogen atom detected from a few to several hundred a.m.u.. Interpretation (3) has been suggested by the above anomalous accretion.*

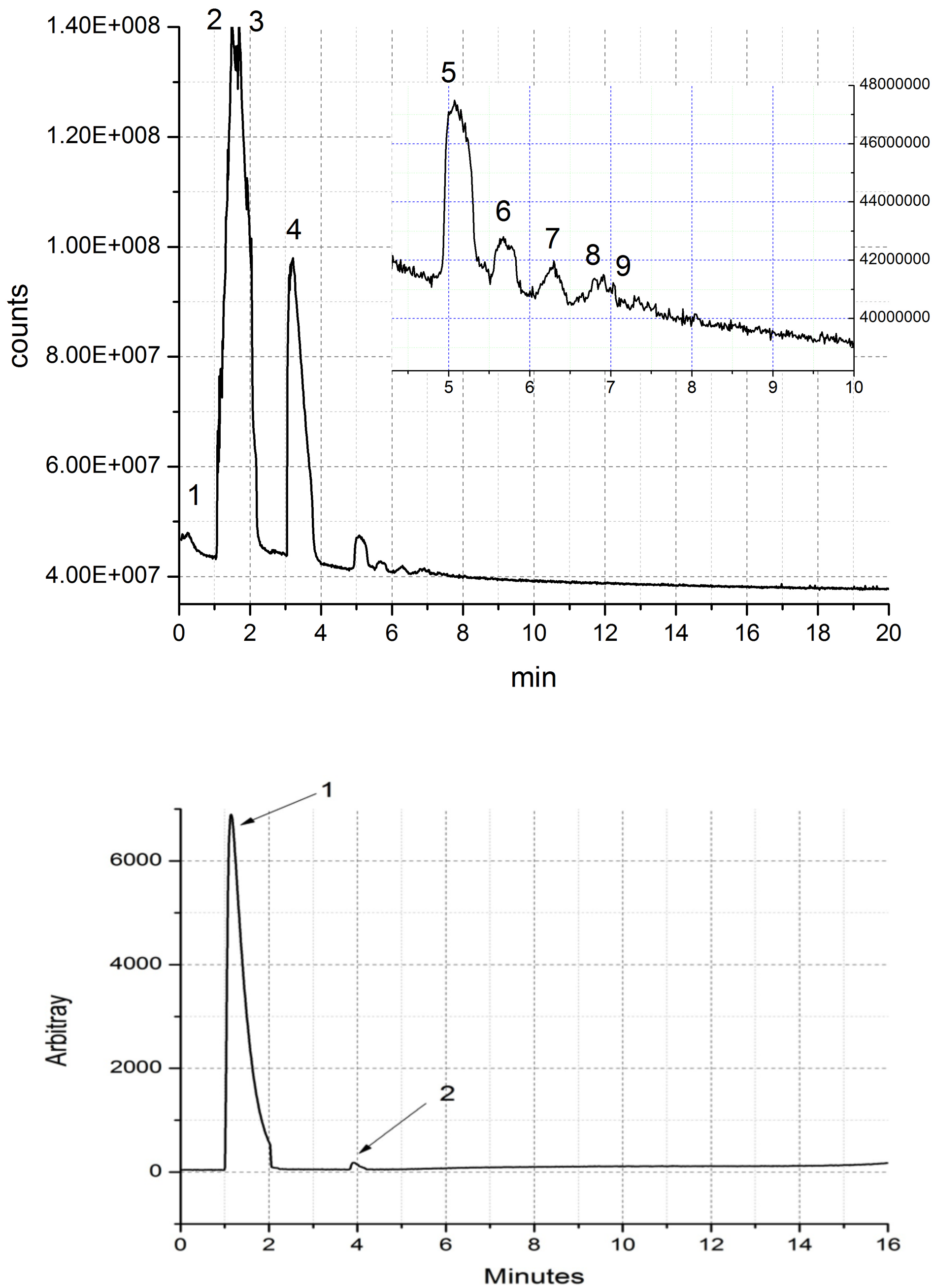

Figure 3: *Representative scans achieved on October 9, 8, 2012, via the GC-MS/IRD described in the test on MagneGas fuel. The top view presents a GC-MS scan from* 2 *a.m.u. to* 500 *a.m.u. with the column operated at* 10 *C and the use of* 22 *minutes elusion time. The bottom view presents the IRD scan of the same gas and the same injection used for the top view, that shows the existence of species well identified in the GC-MS that have no IR signature at their a.m.u., thus confirming their magnecular structure.*

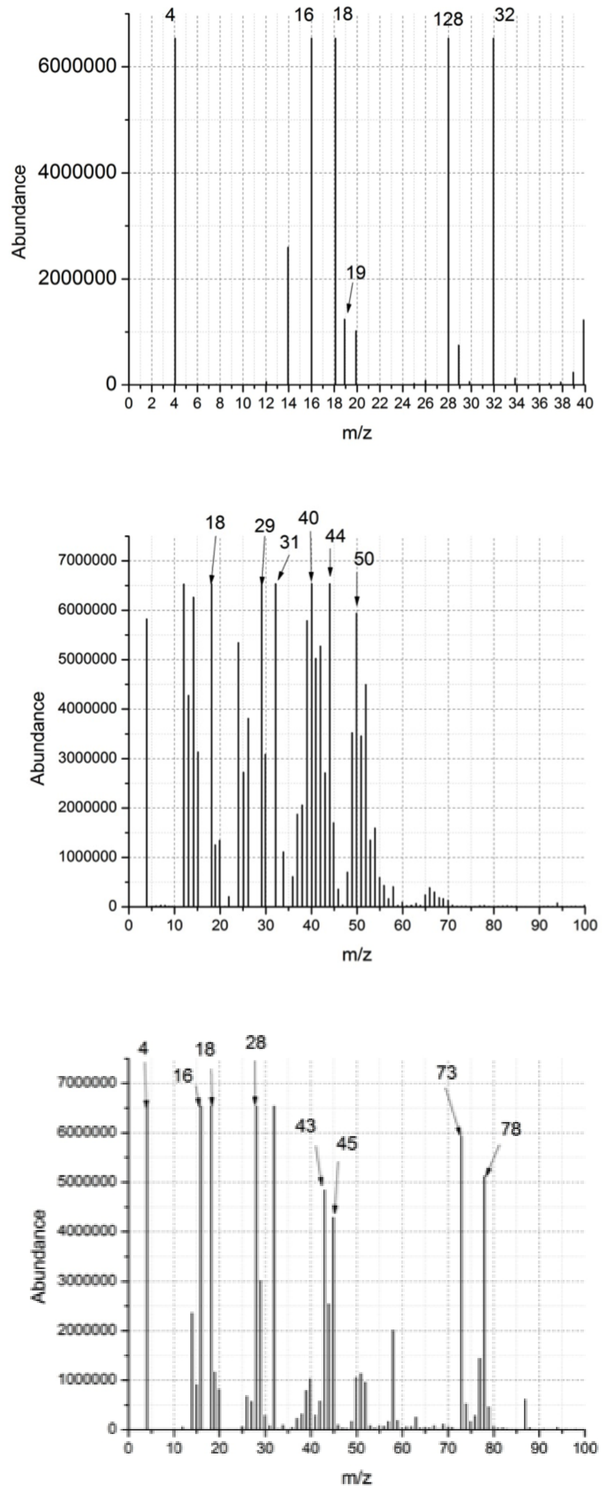

Figure 4: *MS scans of magnecular clusters of Fig. 2 confirming the existence of anomalous species 92)*

ORS REPORT NO.	196379-001
DATE TESTED	8/7/2012
QUANTITY TESTED	1
PACKAGE TYPE	MAGNEGAS CYLINDER

SAMPLE	ID	1	SAMPLE	ID	1
Mass	2	4,732,984	Mass	40	15,538
Mass	3	3,693	Mass	41	31,231
Mass	6	371	Mass	42	18,092
Mass	11	41	Mass	43	8,817
Mass	12	100,209	Mass	44	48,816
Mass	13	70,767	Mass	45	1,189
Mass	14	106,530	Mass	46	226
Mass	15	407,928	Mass	48	287
Mass	16	485,703	Mass	49	1,496
Mass	17	9,663	Mass	50	4,345
Mass	18	3,436	Mass	51	2,955
Mass	19	1,190	Mass	52	3,280
Mass	22	436	Mass	53	2,480
Mass	24	36,642	Mass	54	2,931
Mass	25	124,295	Mass	55	1,494
Mass	26	600,569	Mass	56	1,886
Mass	27	199,348	Mass	57	199
Mass	28	1,893,663	Mass	58	271
Mass	29	62,519	Mass	63	82
Mass	30	9,496	Mass	65	246
Mass	31	1,017	Mass	66	328
Mass	32	20,274	Mass	67	269
Mass	34	82	Mass	68	120
Mass	36	1,296	Mass	70	136
Mass	37	5,843	Mass	73	417
Mass	38	7,803	Mass	77	82
Mass	39	30,692	Mass	78	346

Figure 5: *The scan at ORS laboratories of MagneGas via IVA 110s providing the third independent confirmation of the existence of anomalous species (3) plus the identification of numerous other snot considered in this note for simplicity.*

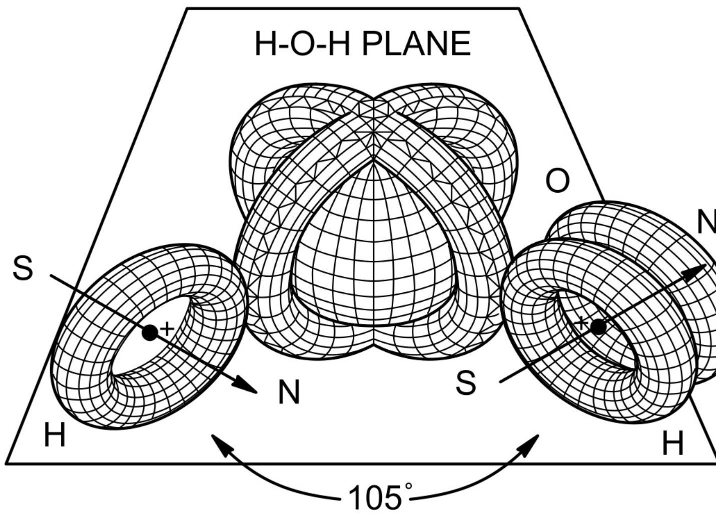

Figure 6: *A conceptual rendering of anomalous species (3a) as a possible quantitative model of the H-bonds in the liquid state of water. Note that the water molecule is represented as it occurs in nature, namely, with polarization of the orbitals perpendicular to the* $H - O - H$ *plane, thus possessing a molecular structure particularly suited for the magnecular bond* $H \times H$.

In Fig. 5, we present the third experimental verification of the existence of the new anomalous species obtained on November 15, 2012, at the Oneida Research Services (ORS) in Whitesboro, NY, via an IVA 110s with an accuracy of $\pm 5\%$ at 5000 *ppmv* (see also Ref. [2] for details). As one can see, the IVA 110s provided an accurate confirmation, not only of the anomalous species at $19, 29$ and 45 *a.m.u.*, but also at numerous other anomalous values from 3 *a.m.u.* to hundreds of *a.m.u.* not considered in this note for brevity.

We would like to close this note with a few comments on the possible connections between anomalous species (3a) and the liquid state of water. As it is well known, the latter state is widely interpreted as being due to the bond of Hydrogen atoms belonging to different water molecules $H_2O = H - O - H$ (also called "H-bridges"). It is then suggestive to assume that anomalous species (3a) may either represent directly said H-bonds, or provide a significant contribution for its quantitative representation.

In fact, the current understanding of the liquid state of water, even though correct and valuable, is still phenomenological to a considered extent, while by comparison the attractive force in the elementary magncule of Fig. 1 for two Hydrogen atom is numerically known [1]. To illustrate the connection here considered, we provide in Fig. 6 a conceptual rendering of anomalous species (3a) to illustrate its possible representation of the H-bonds in liquid water.

In Fig. 7 we provide a corresponding conceptual rendering of one of the various magnecular H-bonds in the liquid state of water as suggested by the author in Ref. [1], according to which the liquid structure is a magnecular state, namely a state of matter whose bond is of magnecular (rather than valence) type. In particular, it was assumed in Ref. [1] that the boiling temperature is the Curie temperature of magnecular bonds in the liquid state of water. Needless to say, in the event confirmed, similar interpretations are expected to hold for the liquid state of other substances, such as gasoline.

In order not to further delay the already delayed appearance of this note, the author plans to present in a future paper more details in the above interpretation of the liquid state due to its evident environmental, scientific and industrial values, since a deeper quantitative understanding of the liquid structure of gasoline is a premise to attempt the decrease of contaminants in its combustion exhaust.

In closing, the authors shall provide at no cost samples of MagneGas to qualified chemists, provided we receive assurances on the use of the same equipment and the same procedures as those described in this note and in Refs. [1-5].

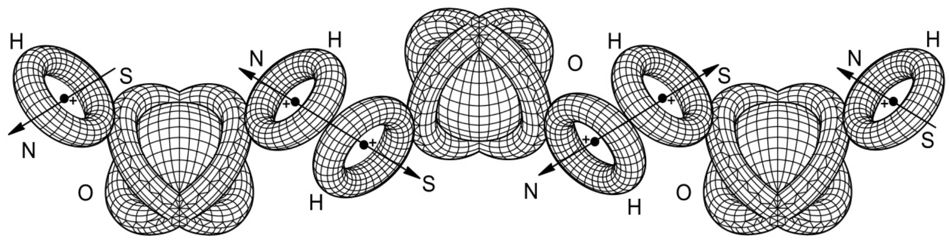

Figure 7: *One of the possible magnecular bonds of H-atoms in the liquid state of water according to Ref. [1]. The second expected magnecular H-bond as in Eq. (3a) is that with the O-atom, resulting in the typical lattice structure of the liquid state.*

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NOTE ADDED:
Following the completion of this paper, various colleagues informed the authors of the recent paper

K. K. Lange, E. I. Tellgren, M. R. Hoffmann, and T. Helgaker, "A Paramagnetic Bonding Mechanism for Diatomics in Strong Magnetic Fields," Science 337, 327 (2012)

which presents a chemical species with a magnetic non-valence bond predicted to exist under strong magnetic fields in certain astrophysical conditions. As one can see from the presentation in this paper and the quoted references, this species is a particular case of Santilli's magnecular bond, since the latter was conceived and tested as the most general possible configuration of electric and magnetic fields between two or more atoms with magnetically polarized orbitals suitable to produce an attraction. In fact, Santilli magnecular bond is also called "axial" or "perpendicular" in the sense indicated in Figure 1. In any case, the measurements presented in this paper constitute experimental evidence obtained on Earth that the magnecular magnetic bond claimed by Lange et al. does indeed exist in astrophysics.

References

[1] R. M. Santilli, *Foundations of Hadronic Chemistry, with Applications to New Clean Energies and Fuels,* Kluwer Academic Publishers (2001), http: //www.santilli-foundation.org/docs/Santilli-113.pdf.

[2] R. M. Santilli, "The novel magnecular species of hydrogen and oxygen with increased specific weight and energy content," Intern. J. Hydrogen Energy **28**, 177-196 (2003), http://www.santilli-foundation.org/docs/Santilli-38.pdf

[3] D. Day,"Report on GC-TCD analysis and density measurements of Santilli Magnehydrogen," Laboratory Report dated 11/10/11 http://www.santilli-foundation.org/docs/Eprida-MH-Certification-10-11.pdf

[4] Y. Yang, J. V. Kadeisvili, and S. Marton, "Experimental Confirmations of Santilli's MagneHydrogen," International Journal of Hydrogen Energy **38**, 5002 (2013) http://www.santilli-foundation.org/docs/MagneHydrogen-2012.pdf

[5] Y. Yang, J. V. Kadeisvili, and S. Marton, Experimental Confirmations of the New Chemical Species of Santilli Magnecules, to be submitted for publication http://www.santilli-foundation.org/docs/Magnecules-2012.pdf

[6] E. Trell,, "Review of Santilli's "Foundations of Hadronic Chemistry," Intern. J. Hydrogen Energy **28**, 251 (2003), http://www.santilli-foundation.org/docs/Trell-review-HC.pdf

[7] I. Gandzha and J. Kadeisvili, *New Sciences for a New Era: Mathematical, Physical and Chemical Discoveries of Ruggero Maria Santilli,* Sankata Printing Press, Nepal (2011), http://www.santilli-foundation.org/docs/RMS.pdf