Michael Baer, J Laser Opt Photonics 2018, Volume:5
DOI: 10.4172/2469-410X-C2-025

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Topological study of the H_3^{++} molecular system: H_3^{++} as a cornerstone for building molecules during the Big Bang

The present study is devoted to the possibility that tri-atomic molecules were formed during or shortly after the Big Bang. For this purpose we consider the ordinary H_3^+ and H_3 molecular systems and the primitive tri-atomic molecular system, H_3^{++}, which, as is shown, behaves differently. The study is carried out by comparing the topological features of these systems as they are reflected through their non-adiabatic coupling terms. Although H_3^{++} is not known to exist as a molecule, we found that it behaves as such at intermediate internal distances. However, this illusion breaks down as its asymptotic region is reached. Our study indicates that whereas H_3^+ and H_3 dissociate smoothly, the H_3^{++} does not seem to do so. Nevertheless, the fact that H_3^{++} is capable of living as a molecule on borrowed time enables it to catch an electron and form a molecule via the reaction $H_3^{++} + e \rightarrow H_3^+$ that may dissociate properly:

$$H_3^+ \rightarrow \begin{cases} H^+ + H_2 \\ H + H_2^+ \end{cases}$$

Thus, the two unique features acquired by H_3^{++}, namely, that it is the most primitive system formed by three protons and one electron and topologically, still remain for an instant a molecule, may make it the sole candidate for becoming the cornerstone for creating the molecules. Corollary – NACTs as Gluons: In order to discuss the buildup of protons Gell-mann and Zweig suggested that Hadrons (e.g. protons) are made out of smaller particles called Quarks. Quarks (usually three of them) are assumed to be hold together by particles - Gluons - that convey the force among them. In the present case, we face a similar problem, viz., building-up a molecular system out of protons and electrons. Indeed the Born-Oppenheimer-Huang (BOH) approach supplies us with the means to build the required magnitudes- the NACTs - as discussed in the above Molec. Phys. Article. Thus, the NACTs stand for the gluon that enforces the nuclei to form the molecule.

Biography

Michael Baer is currently working as Adjunct Professor at Fritz-Haber Center for Molecular Dynamics, The Hebrew University in Jerusalem, Israel. He got his Post-doc at the Department of Chemistry in University of Houston, USA. Later, he became Research Fellow at the A A Noyes Lab of Chemical Physics, California Institute of Technology, Pasadena, California. After Mandatory retirement in 2001, he has been travelling all over the world and served as Guest Professor in IISER India, Free University of Berlin in Germany, University of Debrecen in Hungary, University of Houston in USA and Harvard Smithsonian Center for Astrophysics in USA, etc. He has published 4 books and about 335 publications in reviewed journals.

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