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THE PRODUCTION OF FRÖHLICH AND BOSE-EINSTEIN COHERENT STATES IN *IN VITRO* PARACRYSTALINE OLIGOMERS USING PHASE CONTROL LASER INTERFEROMETRY

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Abstract. Biophysical aspects of Frohlich coherent states and Einstein-Bose Condensates on nanoscale brain structures such as the microtubule, synaptic grid, or ion channel have been considered relevant to information processing through quasiparticle scattering as a putative foundation for a quantum theory of consciousness. Although the body of theoretical evidence for Frohlich type events in biological systems has been growing for thirty years, the highly speculative nature of this model has hindered broad acceptance in the scientific community. In this paper, as a prelude to in vivo experimentation, a theoretical model is described for creating empirically measurable coherent states in vitro microtubule and DNA Oligomers using a system of modulated tuneable-laser interferometry in resonance with an applied Frohlich frequency to drive the collective dynamics of superradiance and self-induced transparency deemed essential for Frohlich and Bose-Einstein effects in biological systems. Empirical realization of this model would open the door to experimental study of the physical parameters of consciousness.

Keywords: Coherent states, Laser interferometry, Paracrystalline oligomers

1. Introduction

Fröhlich and Bose-Einstein Coherence have become central to quantum theories of mind-body interaction [1,2,3,4]; and the Bose-Einstein condensate has been suggested for the basis of a conscious computer [5,6]. The recent isolation for the first time of Bose-Einstein condensates by Anderson et al [7] sets the stage for the long awaited empirical study of these phenomena. Although Bose condensation has been generally studied at cryogenic temperatures in liquid Helium; it has long been believed that similar ground state boundary conditions exist in biological Oligomers at cell temperature. The major criticism by physicists is that at biological temperatures conditions for Bose condensation will be eradicated by thermalization. However at Frohlich frequencies it is believed that conformational changes occur fast enough to avoid thermal effects and not violate the thermodynamic limit.

Molecules containing one or more asymmetric carbon atoms have the property of optical activity; meaning they will rotate the plane of incident polarized light. Symmetric molecules do not have this ability because every optical rotation in one direction is canceled by an equal rotation in the opposite direction.

It is generally known from organic chemistry that the electric field of an incident light beam can perturb the electrons in a molecule producing a conformational change. It follows that this resonant perturbation of the electrons by the oscillating electric field can produce a polarization of the electrons in the molecule. Oligomers have physical freedom of rotation at the C - C single bond yielding the theoretical possibility of an infinite number of conformations. Under native conditions of temperature and Ph conformation is constrained by various factors. It is the native conformation that is responsible for the general biological activity of living systems. It is suggested that the native conformational activity be defined as a ground state. If putative Frohlich or Bose phenomena occur in living systems they are induced by or induce conformational change. This change to another energetic state by entrained electron polarization contains a coherent long range order.

$$\mu = -\sum_i q_i \, r_i \qquad (1)$$

$$\Delta E = h\nu = \frac{hc}{\lambda} \qquad (2)$$

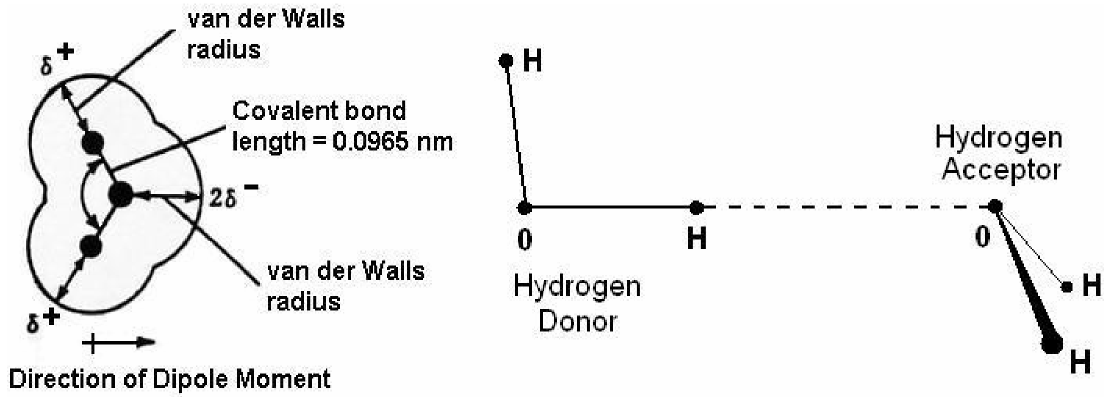

Figure 1. A model of a simple molecule showing its dipole moment. The dipole oscillation by incident photons produces conformational change in optically active Oligomers.

Fig. 1 shows a model of a simple molecule and its dipole moment. Eq. (1) is the vector potential of a dipole moment; which is the product of the charge q and radius r. Conformational variation can originate in the energy variance from the ground state by incident photons. Eq. (2) shows the change in energy E depends on Planck's constant and either the frequency v or wavelength. This is postulated to occur with Fröhlich or Bose-Einstein correlations in vivo.

Beck et al [8] suggests further involvement of the ejection of a tunneling quasiparticle as a mechanism for excocytosis at the synapse. Quasiparticle scattering from neural states into Bose condensation bridges the causal gap between Poppers world I and II [4,8]. Also aspects of intentionality involve the Eccles Psychon [4].

A theoretical model for the production of Fermi and Bose coherent states in vitro Oligomers is presented in this paper. It is hoped that this methodology will have utility in isolating the biophysical parameters surrounding these processes. This data is a necessary prelude to in vivo investigation of the physical aspects of consciousness and for forming a comprehensive quantum theory of consciousness.

2. Photon Induced Conformation

Fig. 2 shows simple model of the peptide molecule illustrating the planar structure and C - C and N - C bonds where conformal rotation can occur by optical activity. According to classical electromagnetic theory oscillating dipole moments emit secondary electromagnetic radiation. Secondary radiation by optically active Oligomers is significant to quantum brain dynamics. The Oligomers instantaneously return to their native conformation, propagating the coherent state, facilitating the self induced transparency. This cycle is required for Frohlich and Bose-Einstein phenomena to be an integral mechanism in the quantum brain dynamics of consciousness. These variables possess long range coherence [1,2].

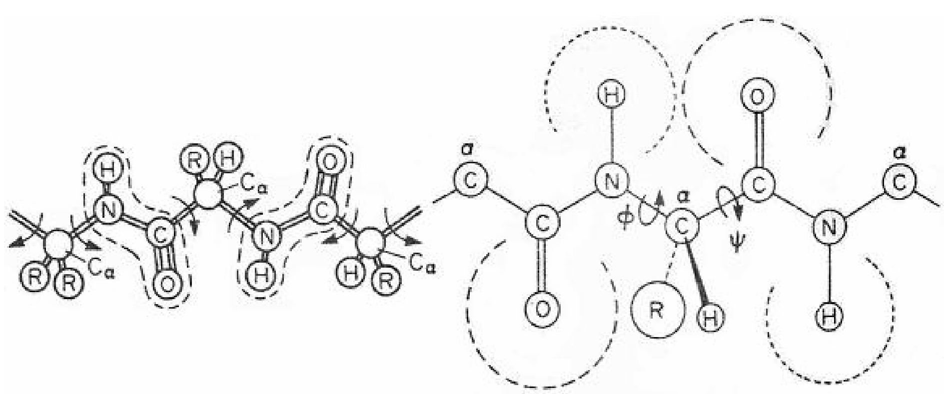

Fig. 2. A simple model of the peptide molecule showing the planar structure and C - C and N - C bonds where conformal rotation can occur by optical activity. Reprinted from Lehninger, 1977 [24].

Conformation of the quaternary structure of oligomeric globular proteins is a dynamic process amenable to perturbation by dipole moments and Van der Waal forces of molecules in their native state.

Parameters affecting conformation can be simulated by a form of phase control laser interferometry to induce the spontaneous production of long range coherence.

Laser-like geometries for coherence brightening [9] effects may occur in several ways. Firstly, is the well described Frohlich and Bose states [1,2,3,4]. Secondly is the newer field of photon localization or photon - atom bound states [10]. A photon bound state may approach the zero kinetic energy needed for condensation.

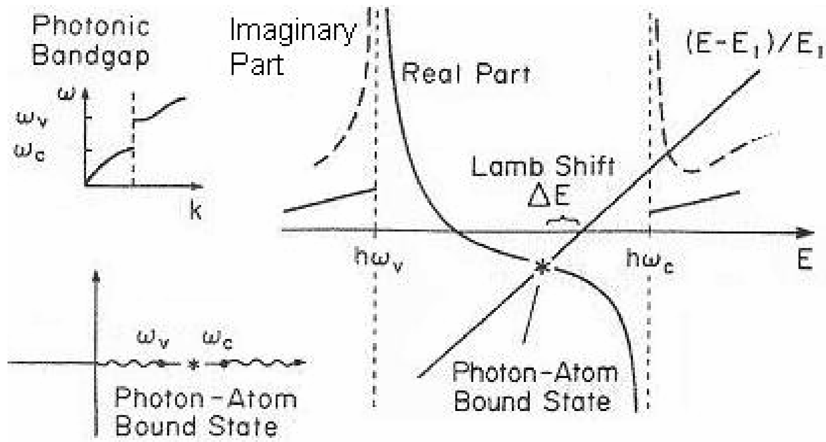

Figure 3. The photon bandgap of the photon - atom bound state. The vertical dotted lines illustrate the bandgap. The eigenvalue solution is the intersection of the straight line with the curved solid line. Reprinted from John 1995.

Localization of light is a fundamental coupling between electromagnetic radiation and matter.
The coupling effect noted occurs in a periodic dielectric geometry with a photonic bandgap [10]. There is an optimal volume filling fraction for creation of a complete photonic bandgap. This depends on resonances that optimize the volume [10].

3. Fröhlich Optical Tweezer

Optical trapping utilizing radiation pressure is finding wide usage since it was first proposed by Ashkin [11,12,13] in 1970 when he suggested that counter propagating laser beams be used to trap atoms. The advent of the optical tweezer has provided methodologies for use in separation, velocity analysis, and trapping [12]. Continuous wave tuneable lasers are now used to trap particles in the three spacetime dimensions. "Like a tractor beam an optical tweezer can catch and manipulate objects without touching them" [14]. Optical trapping uses a fairly high energy of 100's of mw.

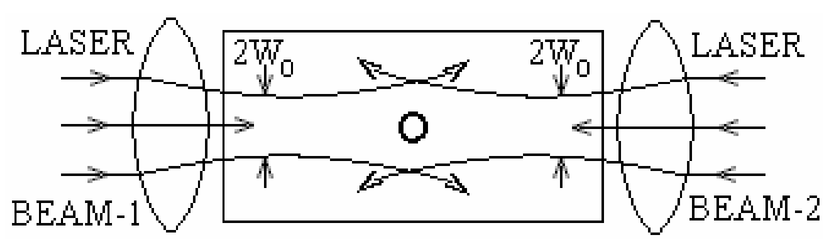

Figure 4. The apparatus for weakly focused counter-propagating laser beams acting as an optical trap. Reprinted from Ashkin, {11,12].

Atoms are driven in the direction of light propagation by a scattering force; and a gradient force draws atoms into or pushes them out of areas of high photon intensity. Significantly, light forces are strong on atoms only in areas of resonance transition. [11,12,13].

It is here suggested that a modified optical tweezer apparatus could be used to duplicate biological conditions and produce Frohlich waves or Bose condensation in vitro. If a large cavity standard optical tweezer apparatus is used to confine polypeptides or DNA Oligomers this would provide a stable platform for experimental conformation. A secondary low power counter propagating radiation pressure instrument with variable polarization to control phase interaction would induce dipole oscillations effecting conformation. Coherent phase control can be achieved by using lasers of varying wavelengths. Phase difference variance changes the location of the incident crests and troughs [15,16]. These phase properties of the laser can manipulate the conformational state in a way that might produce photon localization. In addition the incident photons must be modulated at Frohlich frequencies [1] to duplicate boundary conditions for photon bound states or condensation. It is generally known that conformation change in proteins occurs instantaneously; and Frohlich frequencies are required to avoid thermalization effects. Evidence for Frohlich frequencies has been found in Raman Spectroscopy [8,17].

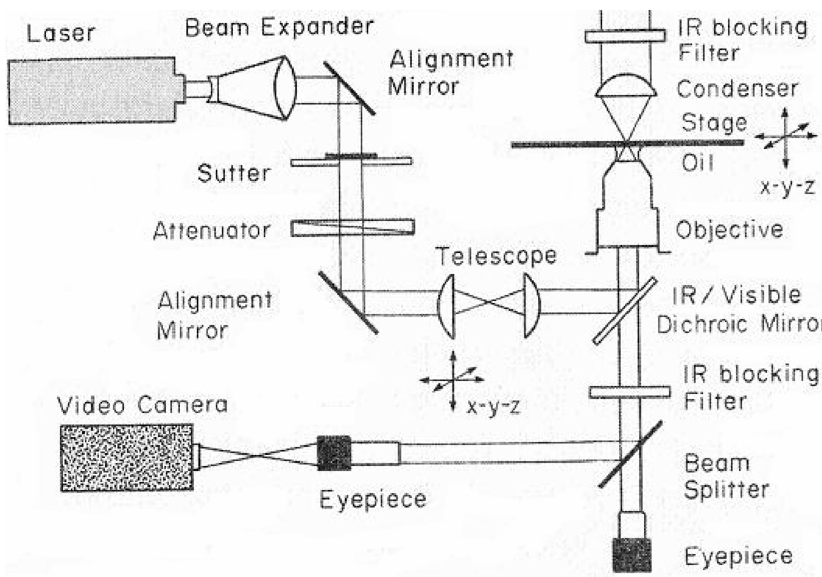

Figure 5. Schematic for a basic optical tweezer apparatus. Frohlich modifications not shown. Reprinted from [14].

The first higher power lasers functions to trap the molecules to be investigated. The secondary lower power laser system serves to manipulate conformation. The Frohlich frequency and phase control interferometry aids duplication of laser-like boundary conditions putatively occurring in biological systems to make Frohlich or Bose-Einstein coherence feasible.

Problems in designing this instrument include issues of whether the laser power needed to trap or confine the molecules for conformal manipilation is too high and would interfere with the production of condensed states. Alternative methods already exist for bonding DNA molecules and microtubules to micron beads. Secondly, measurement of the condensed state is not trivial, and would a sufficient number of molecules at a measurement threshold be compatable with the apparatus. One might bemuse 'How many Einsteins will it take to measure Bose condensation?' An Einstein in this case being an Avogadro number, or mole of photons. Thirdly, the conditions for Bose-Einstein condensation may not readily reproduce at a molecular level, but may require cellular or organismal domains. However this does seem to be the first time in the thirty years since Frohlich presented his theory that we may have enough technology and theory to move dramatically foreward!

4. Conclusion

The technology and theoretical understanding currently exists to duplicate conditions for coherent brain states in vitro. Is Bose-Einstein condensation feasible? Theoretical evidence seems to suggest this is the case. Lasers without population inversion are now possible [18] making possible induced coherence in a ground state. Just because Helium must be at a nanokelvin to Bose condense doesn't preclude geometric states at biological temperatures with zero kinetic energy. Exploration of localized photon may provide insight into alternative boundary conditions. With the isolation of Bose condensates [7] and methodologies available to measure Frohlich fields [19,20,21,22] the future promises exciting realizations.

Coherence in biology and mind seem to be the rule rather than the exception. Popp [23] has found all cells emit biophotons; and they are not merely in the infrared as one might guess in thinking of a person as a 300 watt generator, but cover a spectrum of at least 200 to 900 nm.

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