CONTRAST AND COMPARISON OF VARIOUS TYPES OF BIOLOGICAL COHERENCE AND ENERGY TRANSFER

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ABSTRACT

Highly efficient energy transfer in certain biological systems has been attributed to a degree of coherency. We examine attributes of select systems using three models: Förster's, Fröhlich's, and a relatively new possibility, exciton-coupled quantum wells [1]. We review the basis of each model in an attempt to put them on as comparable a basis as possible. Förster's Model seems well established. Fröhlich's Model considerably less so; however, we present a derivation based on Londonôs zero point energy modifications of classical van der Waals theory resulting in similar expressions. Interestingly enough it can be shown that this result is similar to the field theoretic model of Casimir-Polder. While the Fröhlich model has a potential for efficient coherent energy transfer, it does not seem to have been unequivocally demonstrated. Lastly, we discuss the coupled quantum wells model, a potential new model for biological systems. We then highlight the similarities of the three models with Bose-Einstein condensation (BEC).

[1] S. Yang, A. T. Hammack, M. M. Fogler, L. V. Butov, A. C. Gossard, Phys. Rev Lett, **97**, 187402 (2006).