

## **Linear absorption of a dimer in a quantum harmonic bath: Application to the water soluble chlorophyll binding protein**

T.-C. Dinh and T. Renger

*Institute for Theoretical Physics, Johannes-Kepler-University Linz, Altenberger Strasse 69, 4040 Linz, Austria E-mail: thanh-chung.dinh@jku.at,*

Motivated by the idea of copying the high efficiency of energy transfer of the natural photosynthesis we investigate the linear absorption spectra of pigment-protein complexes. One difficulty when modeling these systems originates from the fact that the interaction between pigments and the one between pigment and the protein are in the same order of magnitude. In case where one interaction is much stronger than the other standard theories (e.g. Förster-theory or Redfield-theory) exist to describe optical spectra and excitation energy transfer. For the case where both interactions are equally strong nonperturbative theories are needed.

In our work we use the dimer-model embedded in a bath of infinitely many quantum-mechanical harmonic oscillators to simulate optical spectra of the water soluble chlorophyll binding protein (WSCP). We introduce potential energy surfaces (PES) of delocalized electronic states and include the dynamical coupling between these PES's in first order perturbation theory.

Our results are compared with standard approaches and a prediction is made about the geometry of transition dipole moments of the chlorophylls in the WSCP.