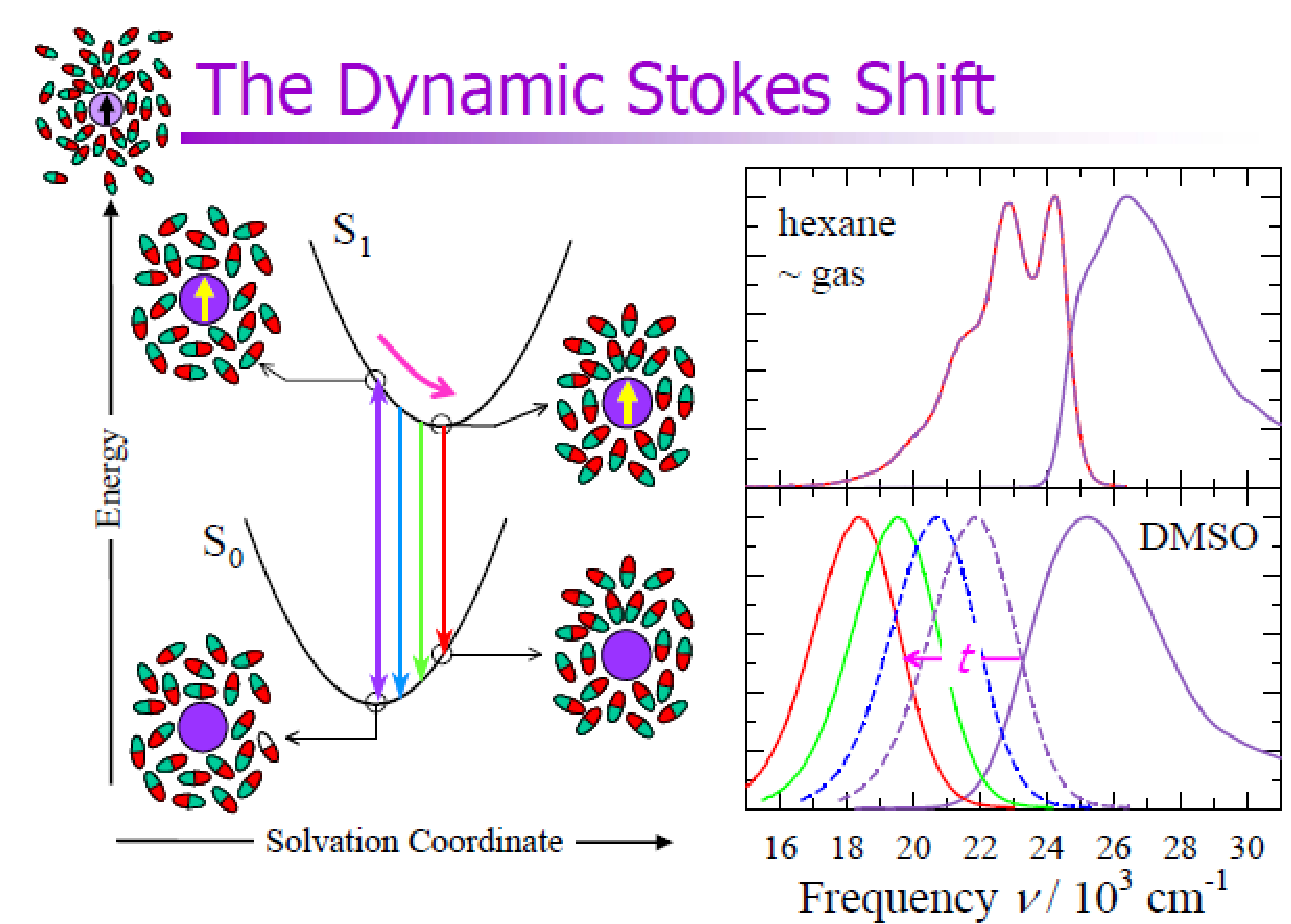




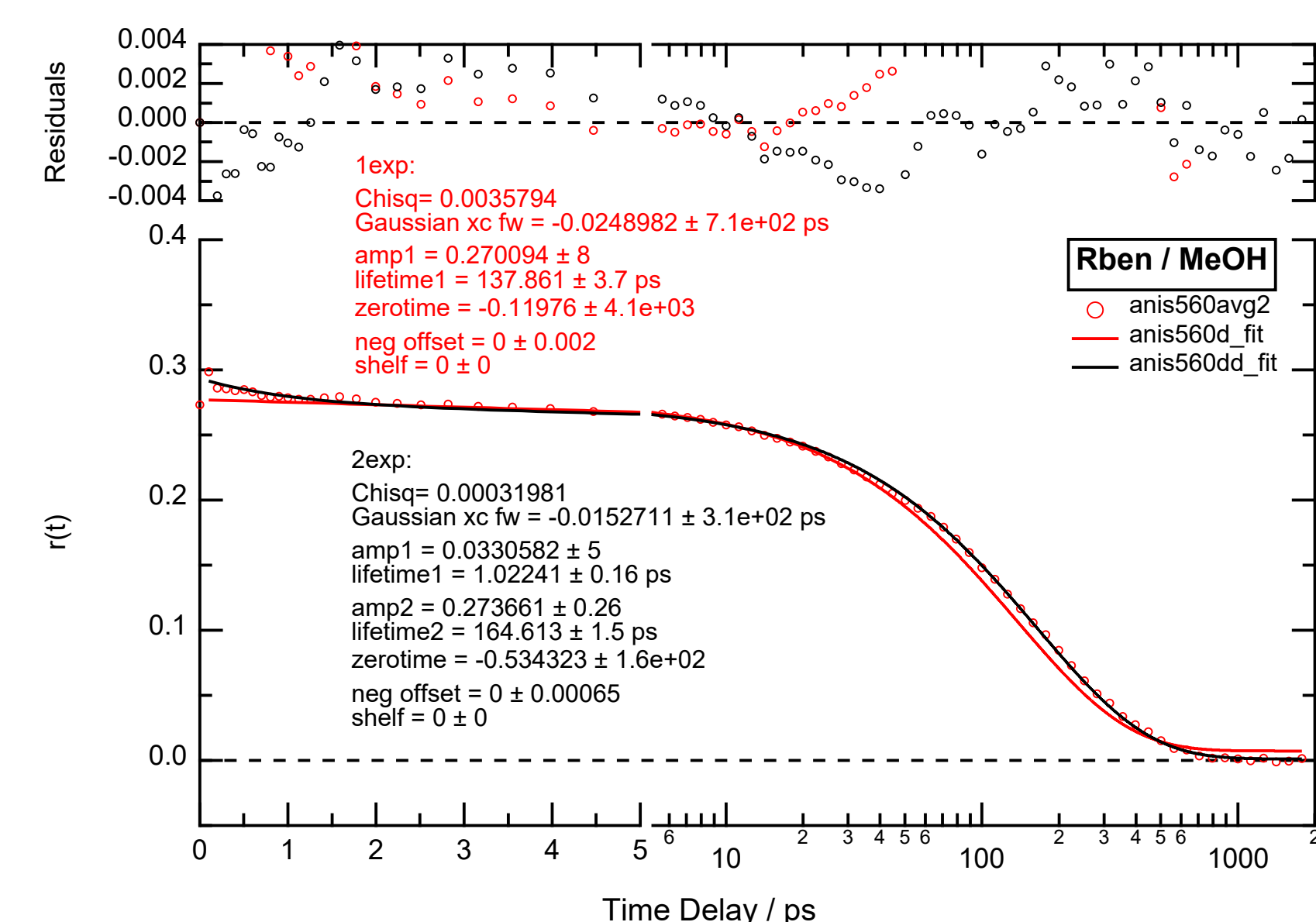
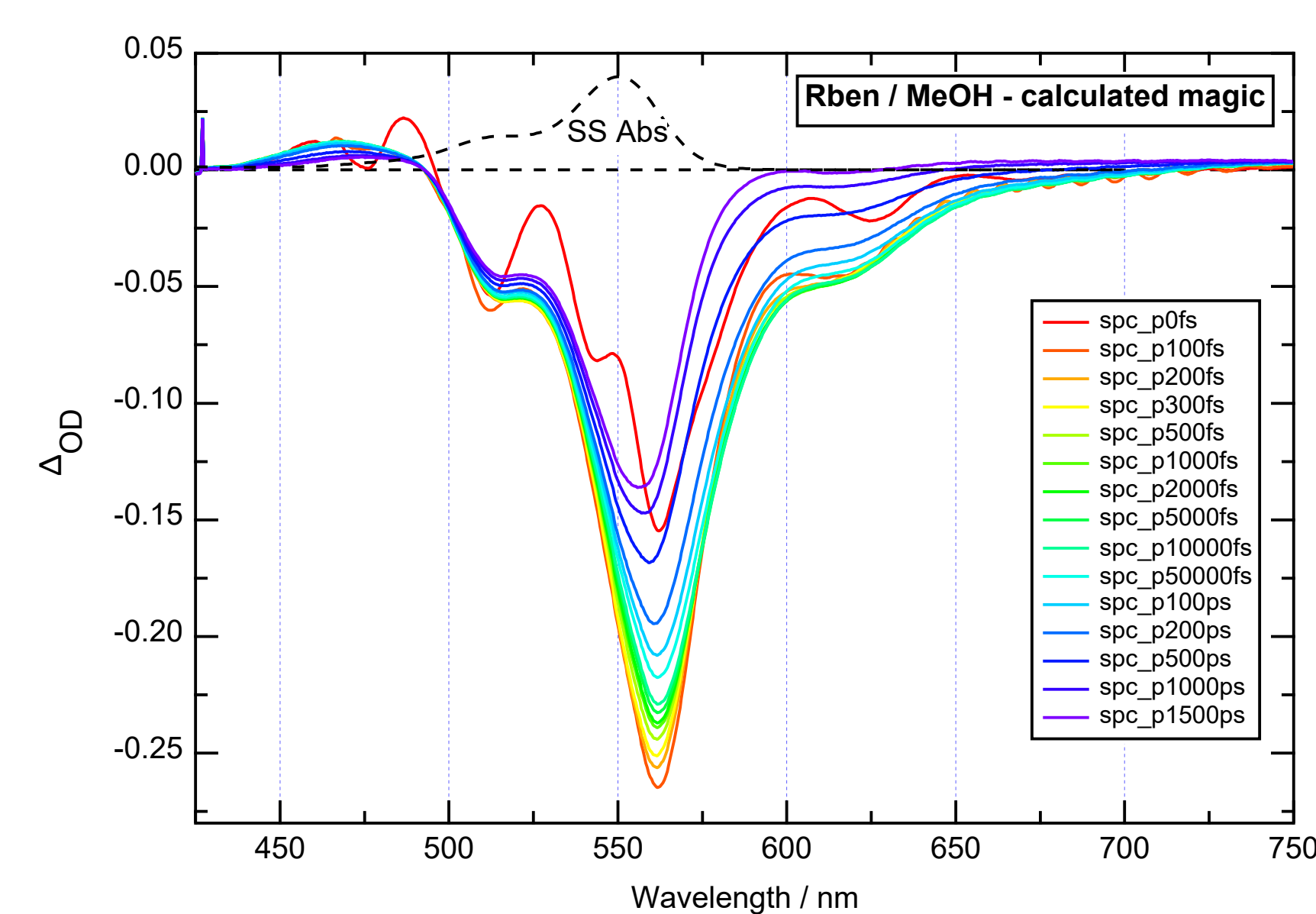
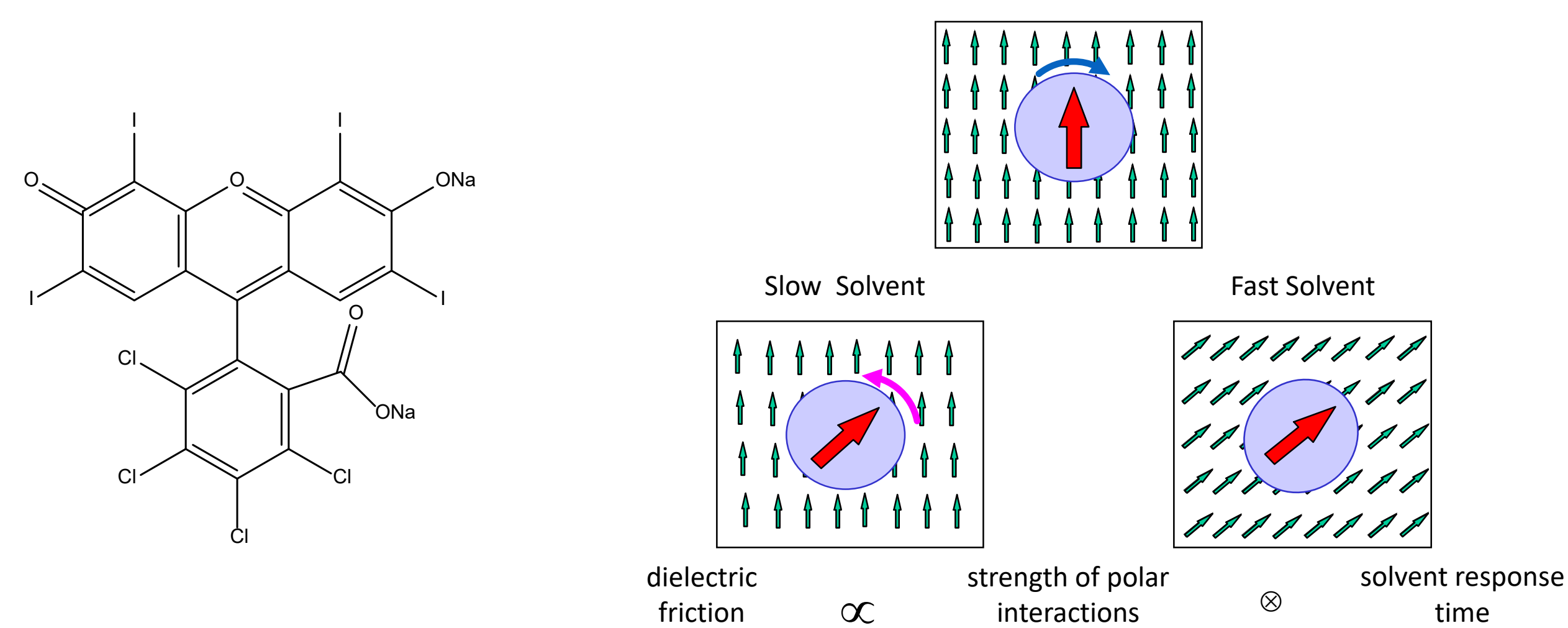
Abstract

The goal of this research is to determine the solvation dynamics in four environmentally-friendly, "green", phosphonium ionic liquids (PILs) + cosolvent binary mixtures. Rose Bengal is a prototypical fluorescent molecule known for its spectral sensitivity and is used to probe the IL mixtures. Neat ILs and methanol (MeOH) solvents were used to form an array of IL mixtures in which rose Bengal was dissolved. Solvation of rose Bengal was determined using steady-state and time-resolved fluorescence spectroscopy. The rose Bengal steady state data shows a systematic blue shift as PIL is added to solution. The solute emission intensity is quenched most effectively at a mole fraction of xPIL ~0.1 suggesting that the solvent-solute interactions are most unique in this range of mole fraction. Similarly, the lifetime data shows a minimum value at xPIL ~0.1 mol fraction PIL, also implying quenching of the probe at this solution composition. Rose Bengal is better solvated, more relaxed, at MeOH-rich mole fractions. The time-resolved center of gravity and associated solvation correlation function, C(t), shows that solvation of rose Bengal occurs at a faster rate in solutions of lower mole fraction PIL.

Solvation and Solvation Dynamics (end goal)

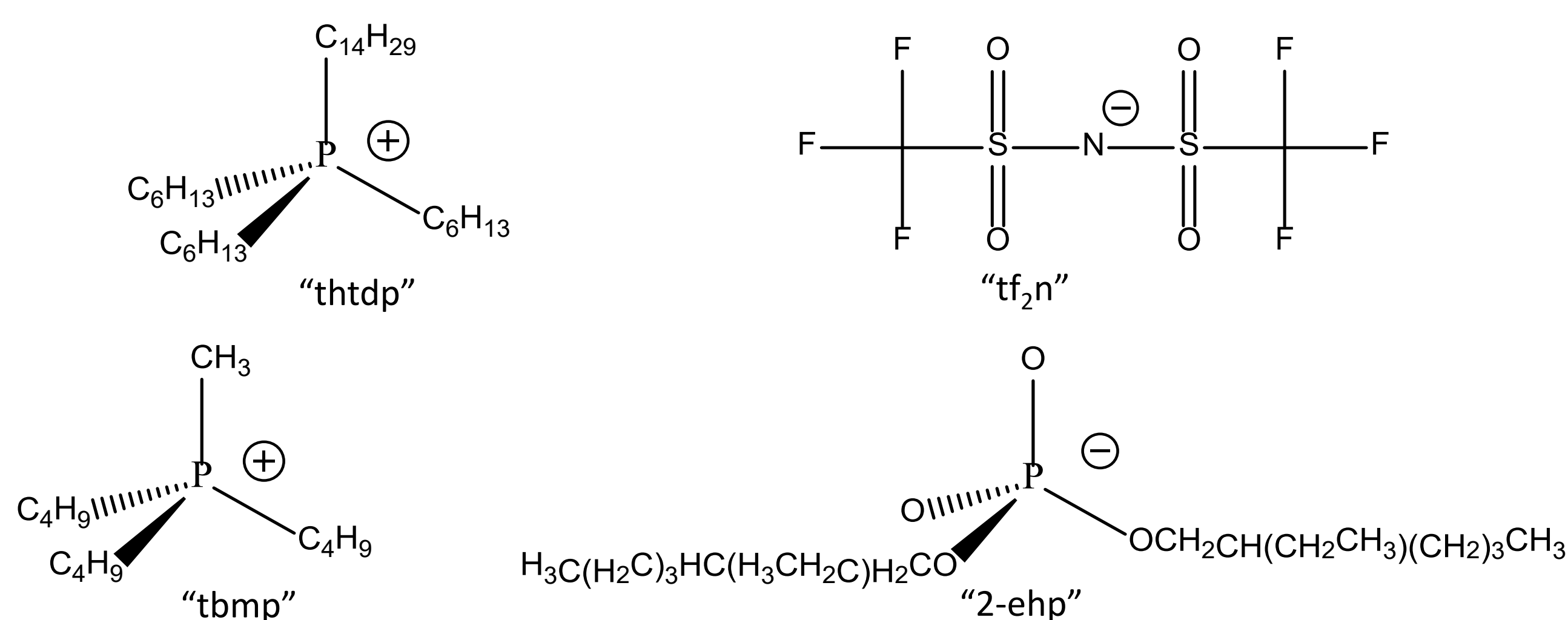


Rose Bengal Absorption in Methanol



Ionic Liquids

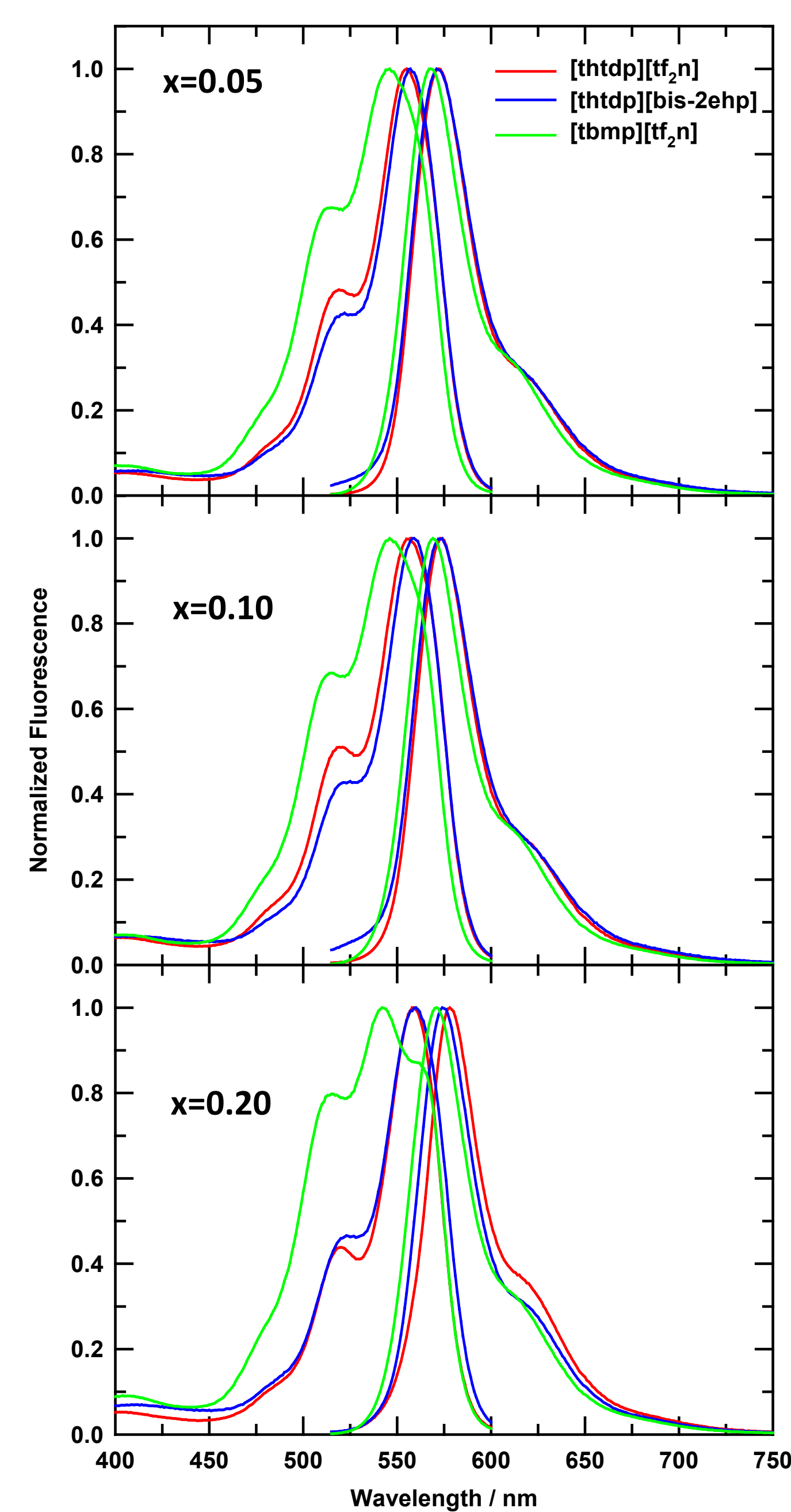
- Ionic liquids (ILs) are salts with melting points at or below 100°C. The properties associated with ILs are the reason for their growing popularity in production and industry.
- The focus of our study is on the solvation of phosphonium ionic liquids + on solvation and rotational dynamics.



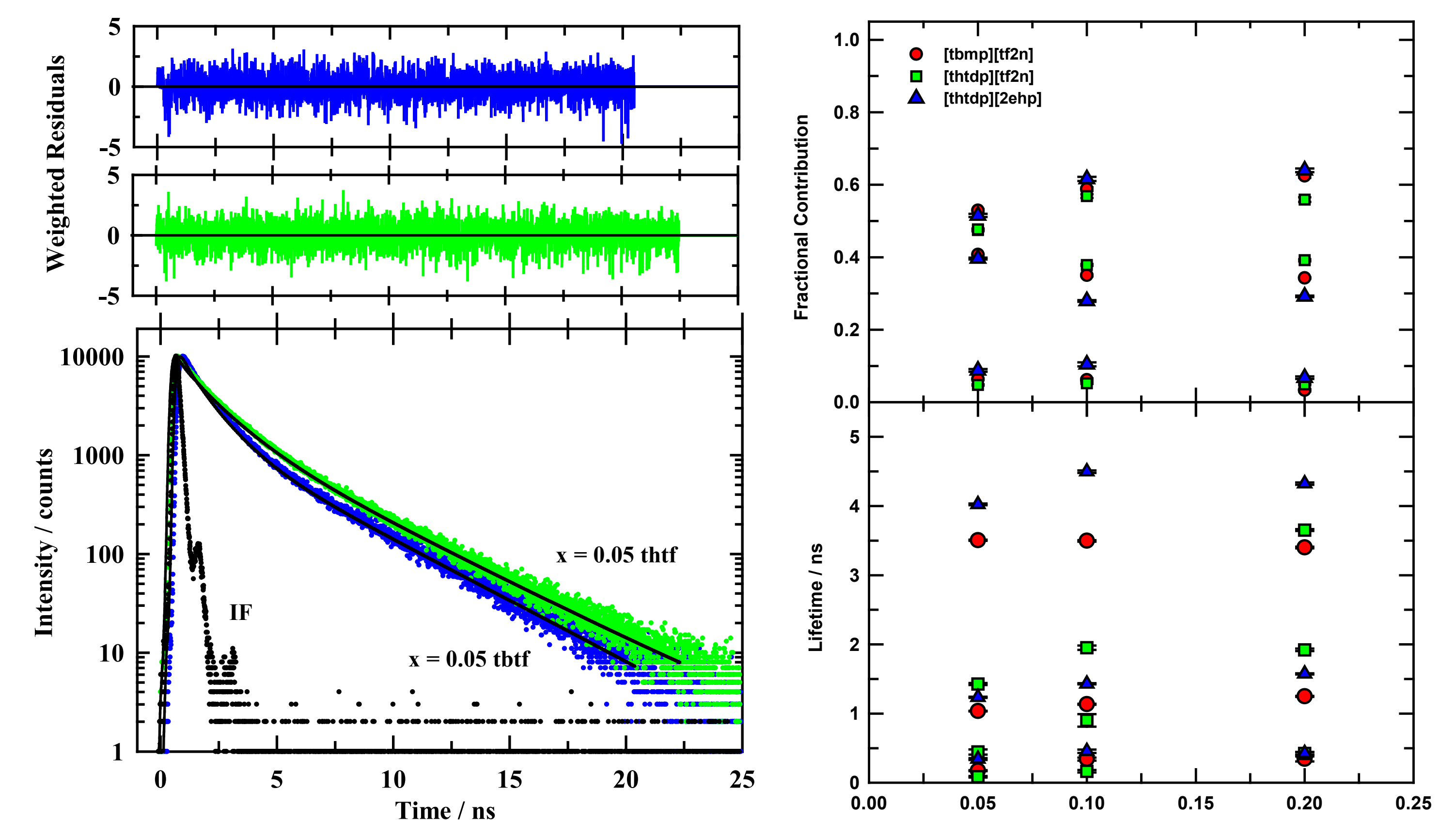
Steady-State Fluorescence Results in ILs

The following graphs show the relationship between various ionic liquids at three different mole fractions at steady state excitation and emission.

There is an increase in vibronic structure in the presence of higher IL concentration for the short-chained IL (green line), x_{tbmp/tf₂n} = 0.05 → 0.20.

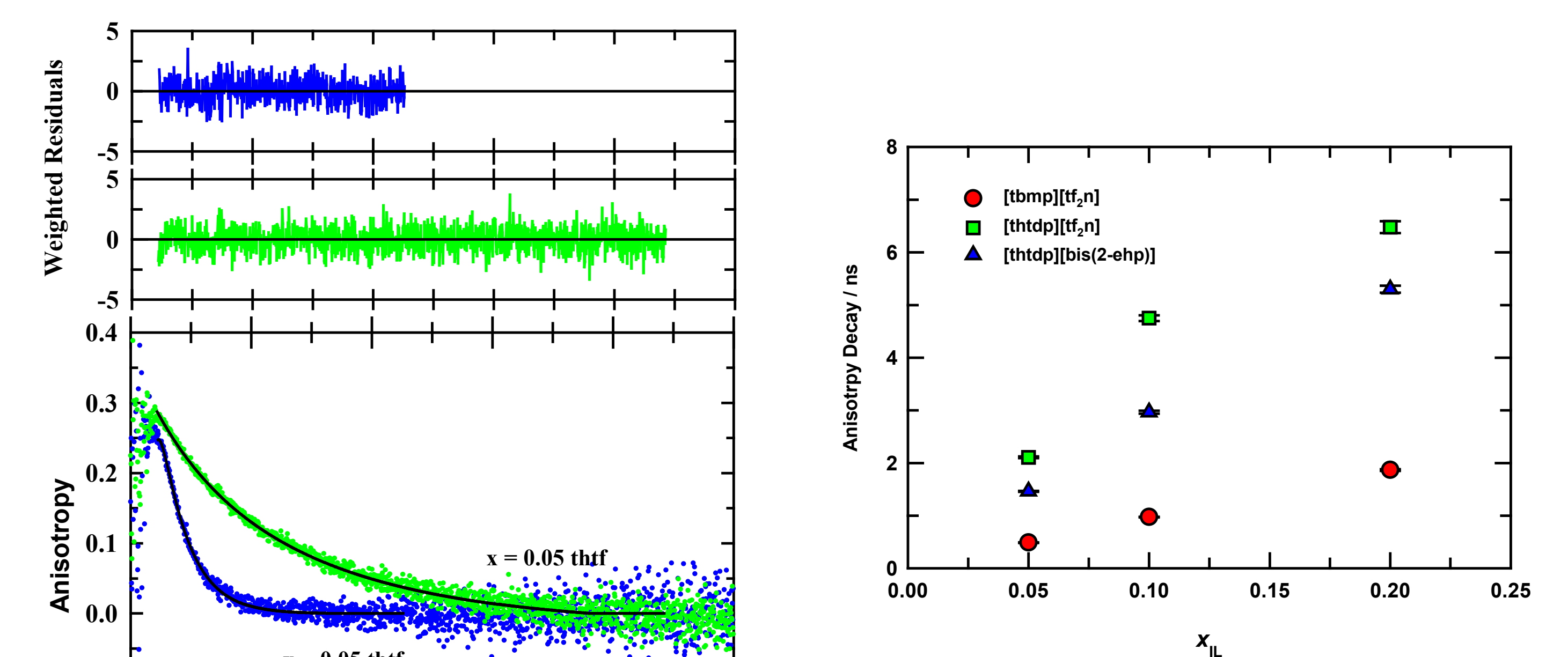


Fits to Fluorescence Intensity Decay Data



This time-resolved fluorescence data was shown to be best fit to three exponentials

Fluorescence Anisotropy Decay Data



Solvent organization around the fluorescent probe changes substantially as indicated by the significant rise in rotational dynamics.

- Cation chain length has the more significant – likely the change in IL aggregation [thtdp][tf₂n] > [tbmp][tf₂n]
- With long-chain ILs, surprisingly, solvent coupling appears weaker for 2-ehp

Conclusions

- It was concluded that the probe was best quenched at a mole fraction of 0.1 IL as shown by the anisotropy data
- We are interested in continuing this research with different mole fractions to observe any changes or similarities of the solvation dynamics

Acknowledgments

- The Department of Chemistry and Biochemistry, The College at Brockport- SUNY