INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: **Analyzing Charge Transfer Spectra arising from non-aromatic amino acids in proteins, aggregating peptides and viral capsid assemblies**

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SHORT ABSTRACT

Novel intrinsic chromophores in apo-proteins lacking aromatic amino acids have gained importance and have been a recent topic of interest. Here in this thesis, Protein Charge Transfer Spectra (ProCharTS), which is proposed to be the origin of such intrinsic absorbance and luminescence features, is being studied. Although the major contribution of Lysine towards ProCharTS phenomenon has been ascertained in highly charge rich proteins. Here we report for the first time, ProCharTS in proteins and peptides rich in Arginine, Aspartate residues, but lacking Lysine residues. Similar absorbance and luminescence properties as that in Lysine-rich protein were observed. ProCharTS can be expected to be evident as long as charge transfer takes place, irrespective of the type of charged species. Since ProCharTS and conventional chromophores like Tryptophan share a similar spectral domain, the influence of ProCharTS on the indole fluorescence in Tryptophan was studied and was found to contaminate the indole fluorescence. Moreover, the decay kinetics from the excited state population in the indole ring was found to be affected by the presence of charged residues, which may explain the multi-exponentiality of Tryptophan fluorescence intensity decay often observed in proteins. Finally, the applicability of ProCharTS on peptide aggregation and viral capsid assembly was studied. ProCharTS was able to monitor the early stages of aggregation in Aβ-derived switch peptides, where the random coil peptides interconvert into β-sheets. Similarly, ProCharTS could detect the formation of the large clusters of HBV core protein dimers into capsids with T=4 and T=3 icosahedral geometry in real-time. The increased interactions among the charged residues at close proximity in the peptide oligomers or HBV capsids are proposed to enhance ProCharTS signal. ProCharTS, being a simple, label-free technique can thus be used for rapid initial screening of drugs for amyloid-linked diseases and viral core protein allosteric modulators (CpAMs), without interfering with the aggregation or capsid assembly kinetics.