Fluorescence Lifetime Nomenclature

1. The fluorescence lifetime is described as

$$t_f = \frac{1}{k_r + k_{nr}}$$

this is what is measured on the streak camera

2. The radiative lifetime is described as

$$t_r = \frac{1}{k_r}$$

and is an intrinsic molecular property.

3. The radiative lifetime is related to the fluorescence quantum yield by

$$t_r = \frac{t_f}{\Phi_f}$$

4. The non-radiative lifetime is described as

$$t_{nr} = \frac{1}{k_{nr}}$$

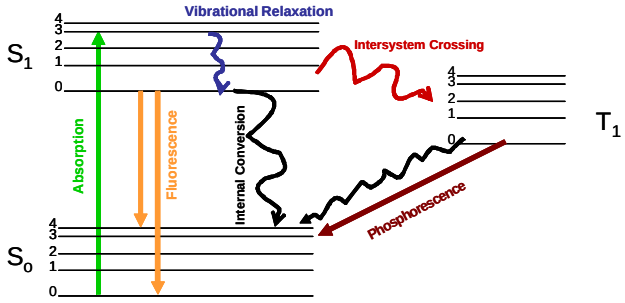
5. The non-radiative rate is the sum of all rates from all non-radiative processes

$k_{nr} = k_{ic} + k_{isc} + k_{quenching} + k_{et} + \ldots$ (others)

and changes with environment.

Parameter	Definition
t_f	Fluorescence Lifetime (measured on streak camera)
k_r	Radiative Rate
t_r	Radiative Lifetime (~ns) (t_n Lakowicz, t_f Turro)
k_{nr}	Non-radiative Rate
t_{nr}	Non-radiative Lifetime
Φ_f	Fluorescence Quantum Yield
k_{ic}	Rate of Internal Conversion
k_{isc}	Rate of Intersystem Crossing
k_{quench}	Rate of Quenching
k_{eet}	Rate of Electronic Energy Transfer

Figure 1. Jablonski Diagram



Event	Typical TimeScale
Absorption	fs
IC and VR	fs-ps
Fluorescence	fs-ns
Phosphoresence	ms-s