Projects @ IPVF

Correlations measurements for photonic conversion

Investigate efficiency of processes where 1 UV photon is converted in 2 visible photons

The Journal of Chemical Physics ARTICLE scitation.org/journal/jcp

A Bayesian approach to luminescent down-conversion

Cite as: J. Chem. Phys. 154, 014201 (2021); doi: 10.1063/5.0026396
Submitted: 24 August 2020 • Accepted: 9 December 2020 •
Published Online: 4 January 2021

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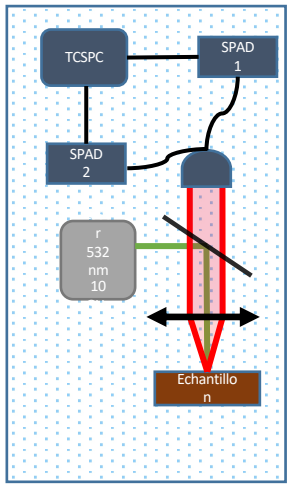
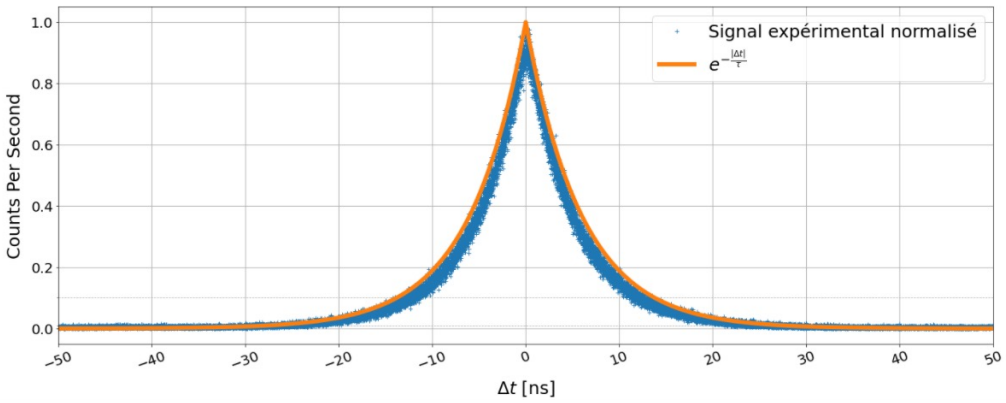
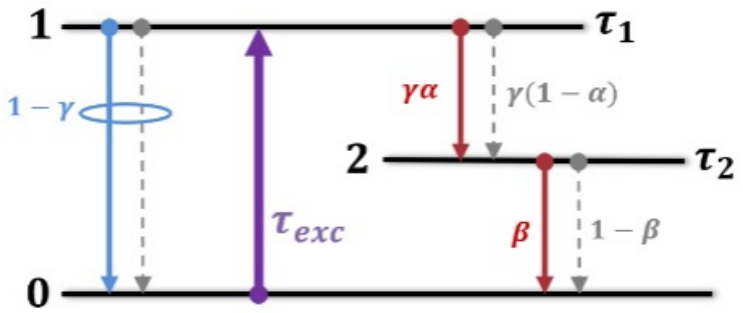
Existing experimental construction





Model

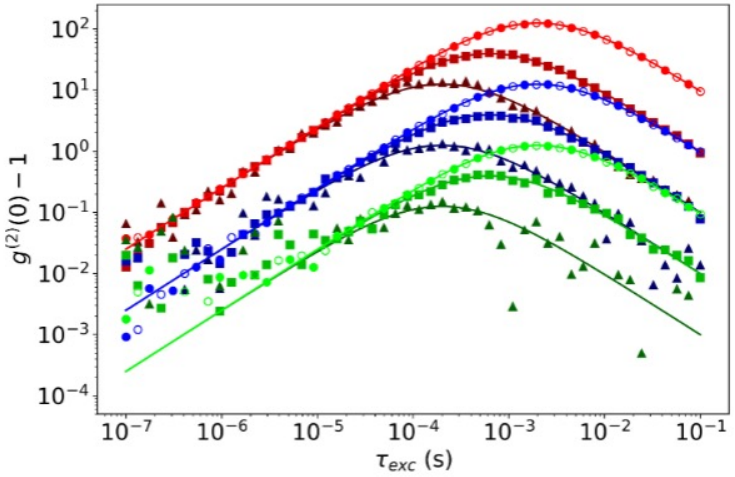


Theory

$$g^{(2)}(0) = 1 + \frac{[P(\mathrm{C}|\mathrm{B}) - P(\mathrm{C})]P(\mathrm{B})}{P(\mathrm{D})^2}$$

$$= 1 + \frac{\tau_{exc}}{\gamma\tau_2} \frac{\alpha\beta}{\left(\alpha + \beta + \frac{\tau_{exc}}{\mathrm{QE}\,\tau_D\,\gamma}\right)^2}$$

Simulations



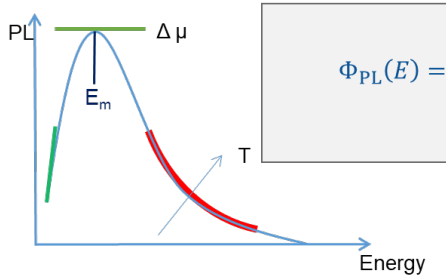
Project on Hyperspectral photoluminescence imaging calibration

Quasi-Fermi level splitting Δμ → Intensity

Gap, lattice temperature → PL peak E_m

Carrier temperature T → High energy tail

Defects , disorder → Low energy tail



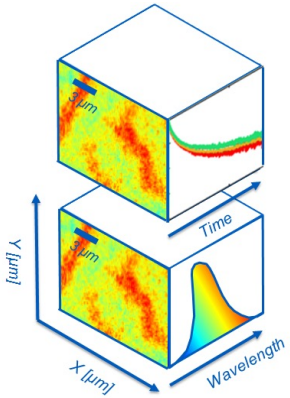
Generalized Planck law:

$$\Phi_{PL}(E) = \frac{A(E)E^2}{4\pi^2\hbar^3c_0^2}\frac{1}{\exp\left(\frac{E-\Delta\mu}{kT}\right)-1}$$

$$\Delta\mu \approx qV$$

(free energy/particle)

T & Δμ are the thermodynamic variables for the energy conversion process

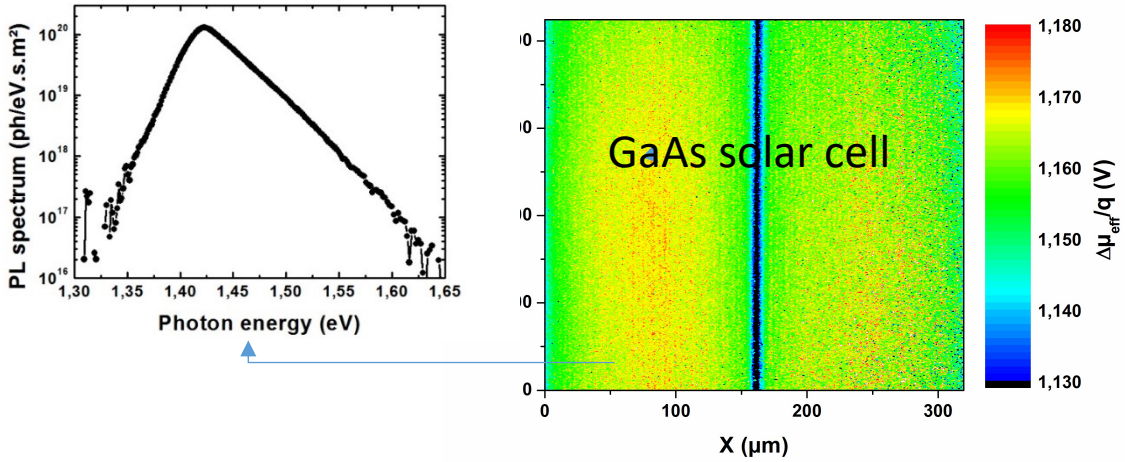


. Hyperspectral imaging: for each pixel of the solar cell, a full luminesecence spectrum is measured

. Each spectrum contains detailed information on the photovoltaic processes and on conversion efficiency losses <u>if it can be calibrated yielding effectively an electrical measurement via purely optical methods</u>

=> Simplify calibration processes

Photoluminescence



	Optical $\Delta\mu_{eff}/q$	Electric V_{OC}
GaAs	1,164 V	1,149 V
CIGS	0,808 V	0,801 V
Halide Perovskite	1,030 V	1,017 V