Controlling light emission: from single molecules to random lasing

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To comprehend light matter interaction should we first decipher its components or instead understand the interplay between its building blocks and its underlying complexity?

In a journey from the nanoscale dimension of a single fluorescent molecule to the macroscopic scale of self-assembled mm-sized photonic materials I will discuss light transport and lasing. I will show how we can get inspiration from recent advances in the synthesis of 3D nanophotonic materials [i] and of novel light sources [ii] to extend the usual picture of a laser to unconventional lasing devices.

I will discuss disordered structures, resonant light diffusion [iii] and random lasing with a-priori designed lasing peak within the gain curve [iv] as well as ordered structures and photonic crystal band-edge laser that are supported by Bloch modes.

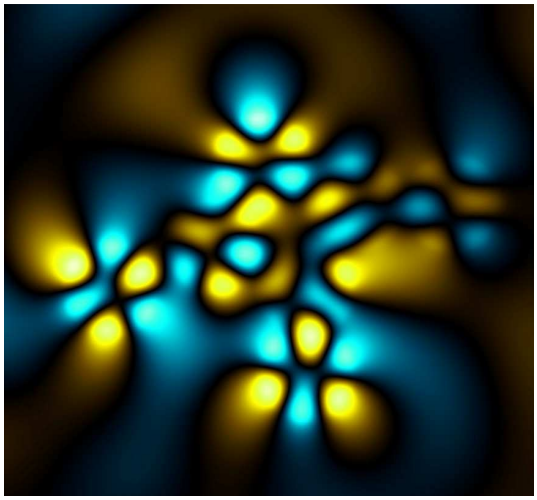

Illustration of Random Lasing in photonic glasses

References:

[i] P. D. García, R. Sapienza, Á. Blanco and C. López, "Photonic glass: a novel random material for light" *Adv. Mater*. **19**, 2597-2602 (2007); P D García, R Sapienza, C López "Photonic Glasses: a step beyond white paint" *Adv. Mater*. **21**, 1-8 (2009);

[ii] M. Leonetti, R. Sapienza, M. Ibisate, C. Conti, C. Lopez "Optical gain in DNA-DCM for lasing in photonic materials " *Opt. Lett.* **34** 3764 (2009)

[iii] R. Sapienza, P.D. García, J. Bertolotti, M.D. Martín, A. Blanco, L. Viña, C. López, D.S. Wiersma, "Observation of Resonant Behavior in the Energy Velocity of Diffused Light" *Phys. Rev. Lett*. **99**, 233902 (2007)

[iv] S. Gottardo, R. Sapienza, P.D. García, A. Blanco, D. S. Wiersma, and C. López, "Resonance driven random lasing" *Nature Photonics* **2** (7), 429-432 (2008)