Plasmonic-enhanced up/down conversion photoluminescence

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The hustle of an efficient phosphor material to overcome the challenges of our modern life is essential. Low power consumption optoelectronic devices, high resolution bio-imaging, and high efficiency photo voltaic cells all require an efficient phosphor material. Different strategies have been implemented to boost the efficiency of phosphors to their maximum, and great achievements have been recorded. However, an increase in their efficiency is required. For example to use solar cells as a real replacement to the traditional power sources, an efficiency of at least 70% is needed, and yet the highest efficiency of the readily available and costly affordable solar panel is about 22.6%.

Plasmonic effect is a promising candidate to further boost the efficacy of phosphor materials. Plasmonic phenomena takes place on the surface of metals due to the nature of the isolating valance electrons. These metals include but not all Au, Ag, Ir, Cu, etc. When the size of these metals synthesized are in a nanoscale form, a strong electromagnetic field is usually generated in the vicinity of the metal nanoparticle upon irradiation with electromagnetic radiation. The characteristic properties (absorption wavelength and FWHM) of the generated electromagnetic field depend on the shape and size of the metal nanoparticle. Via coupling of the plasmonic band and the excitation/emission band of the phosphor, a dramatic enhancement maybe achieved.

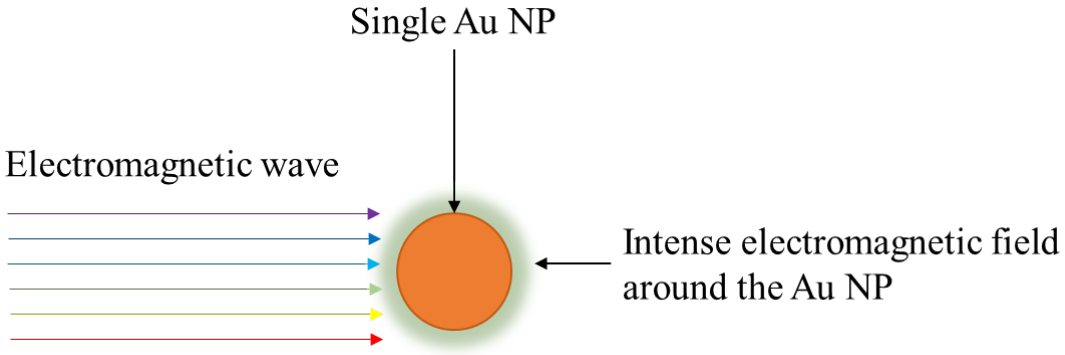

Fig 1. Simple representation of the plasmonic phenomena.