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optical parametric oscillator

Acronym: OPO

Light source similar to a laser, but based on 'non-linear optical gain' from parametric amplification rather than on stimulated emission.

Notes:

1. The device is a powerful solid-state source of broadly tunable coherent radiation. It consists of a crystal, usually BBO (BaB_2O_4), located inside an optical resonator and pumped by a very intense laser beam (typically provided by a pulsed neodymium laser or a diode laser). The pump beam (wavelength λ_p frequency ν_p) is partially converted into two coherent beams, the signal and the idler, with wavelengths (λ_s, λ_I) and frequencies (ν_s, ν_I) such that $\nu_s + \nu_i = \nu_p$. By simultaneous rotation of the crystal and adjustment of the optical resonator, the wavelength of the signal beam is continuously tunable, theoretically from λ_p to $2 \times \lambda_p$ and practically over a slightly more reduced range.
2. For example, for $\lambda_p = 355$ nm (3^{rd} harmonic of a Nd:YAG laser), ν_s can be tuned from 400 nm (with $\lambda_i \approx 3.15$ μm) up to 600 nm (with $\lambda_i \approx 870$ nm).
3. This 'splitting of one photon into two photons' is the reverse of the 'sum frequency mixing' used, for instance, to generate the 3^{rd} harmonic of a laser emission by mixing in a convenient crystal the fundamental and the frequency doubled beams (a way to get the 3^{rd} harmonic much more efficiently than by pure frequency tripling as described under harmonic frequency generation).

Source:

PAC, 2007, *79*, 293 *(Glossary of terms used in photochemistry, 3rd edition (IUPAC Recommendations 2006))* on page 378

