Lasing Without Inversion in XUV Regime

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It is well known that a conventional laser requires population inversion on the lasing transition. But in late 80’s it was proposed [1] and later demonstrated experimentally [2] that this condition does not hold in general when more than two levels are involved in the interaction. In a typical three-level configuration (shown in Fig. 1), it is possible to break the detailed balance and cancel stimulated absorption while keeping the stimulated emission intact. This is the basis of lasing without inversion (LWI) (see in Fig. 2).

Lasing without inversion has gained enormous attention because it holds a great potential for generating short wavelength lasers in the UV and X-ray regime. In such regions of the spectrum, the conventional lasing approach, i.e., population inversion on the lasing transition is difficult to achieve, due to fast spontaneous decay. Until recently [3], the merits of LWI has been used mostly in the visible and IR region of the spectrum which involved continuous incoherent pumping. For short wavelengths of the spectrum incoherent pumping is via electron-atom collision that can destroy the coherence needed for LWI. So for these regimes a transient approach to LWI is taken.

References: