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【111】 Giant Kerr nonlinearity of intersubband transitions –Origin of self-starting frequency combs

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Optical frequency combs refer to the emission of perfectly periodic waveforms of light. These waveforms can be formed due to optical nonlinearities that provide the coherent coupling of the amplitude and phase of the light. We show that Bloch gain serves as the physical origin of the linewidth enhancement factor and that it plays an essential role in the formation of quantum cascade laser combs. We develop a laser master equation to self-consistently include the Bloch gain. Our results explain the generation of self-starting combs in Fabry-Perot QCLs, and the emission of localized structures in ring resonators, akin to dissipative Kerr solitons.

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