

Detailed study on coherent two-photon emission toward the neutrino mass spectroscopy

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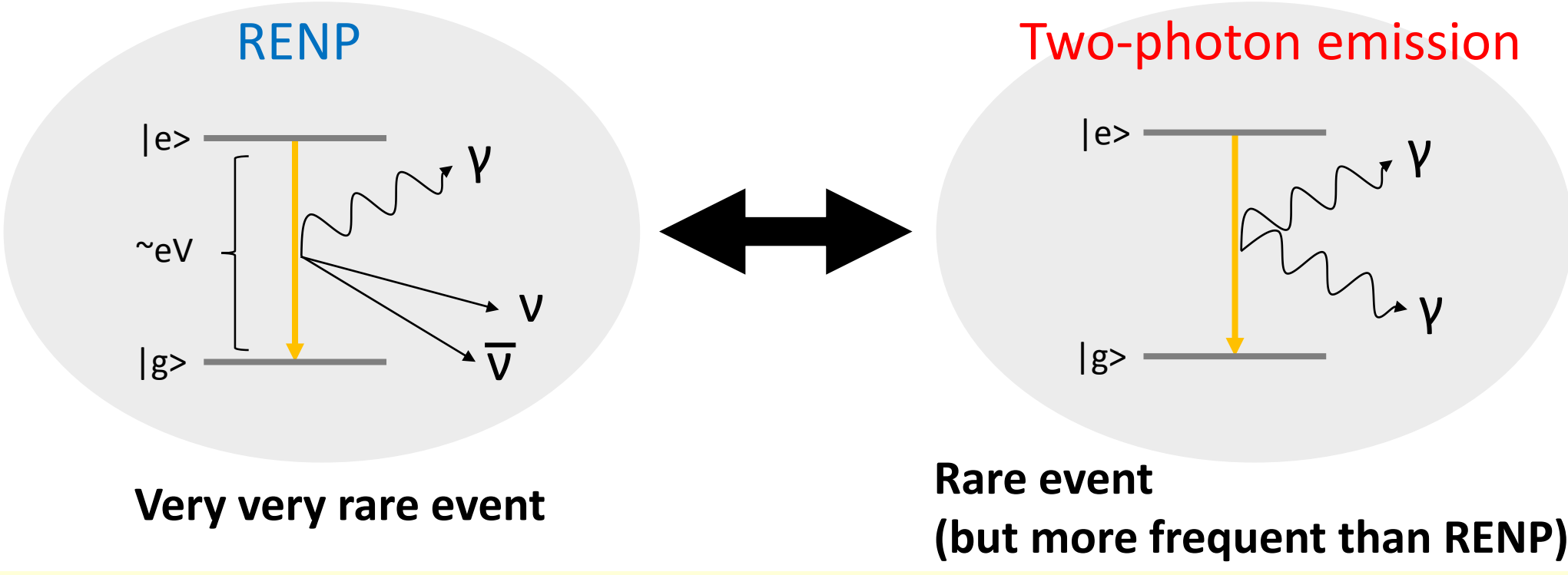
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Coherent amplification is essential for the neutrino mass spectroscopy. We have studied coherent two-photon emission from hydrogen molecules to demonstrate coherent amplification of rare transitions. Two-photon emission between vibrational states of hydrogen molecules are allowed but its rate is quite small. In previous works, externally triggered two-photon emission from coherent vibrational states produced by stimulated Raman process was observed. This presentation provides detailed observation results on dependences of the two-photon emission rate on various experimental parameters together with recent trials to represent them by numerical simulations. Future experimental plan is also discussed.

Introduction

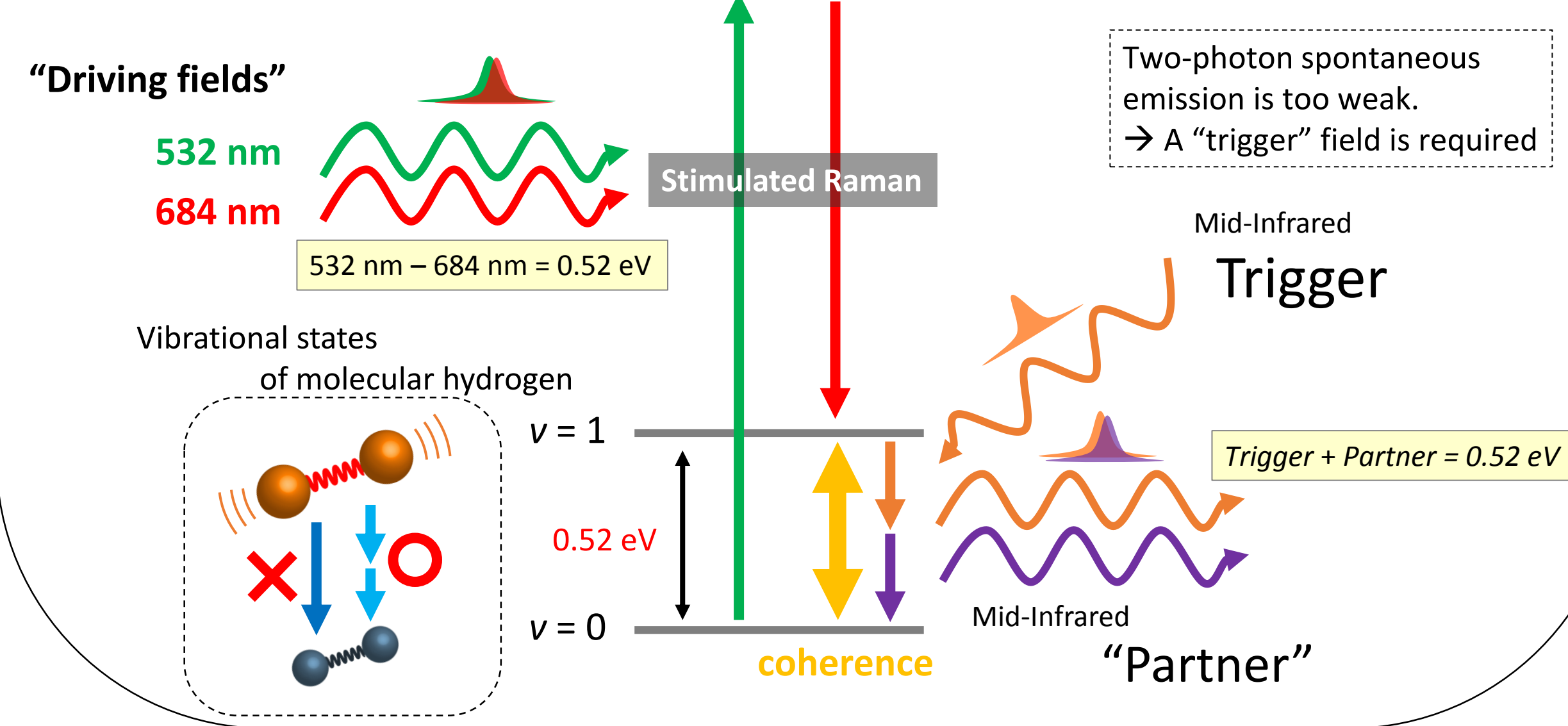
Neutrino Mass Spectroscopy

= Radiative Emission of Neutrino Pair (RENP)
+ Macro-coherent amplification

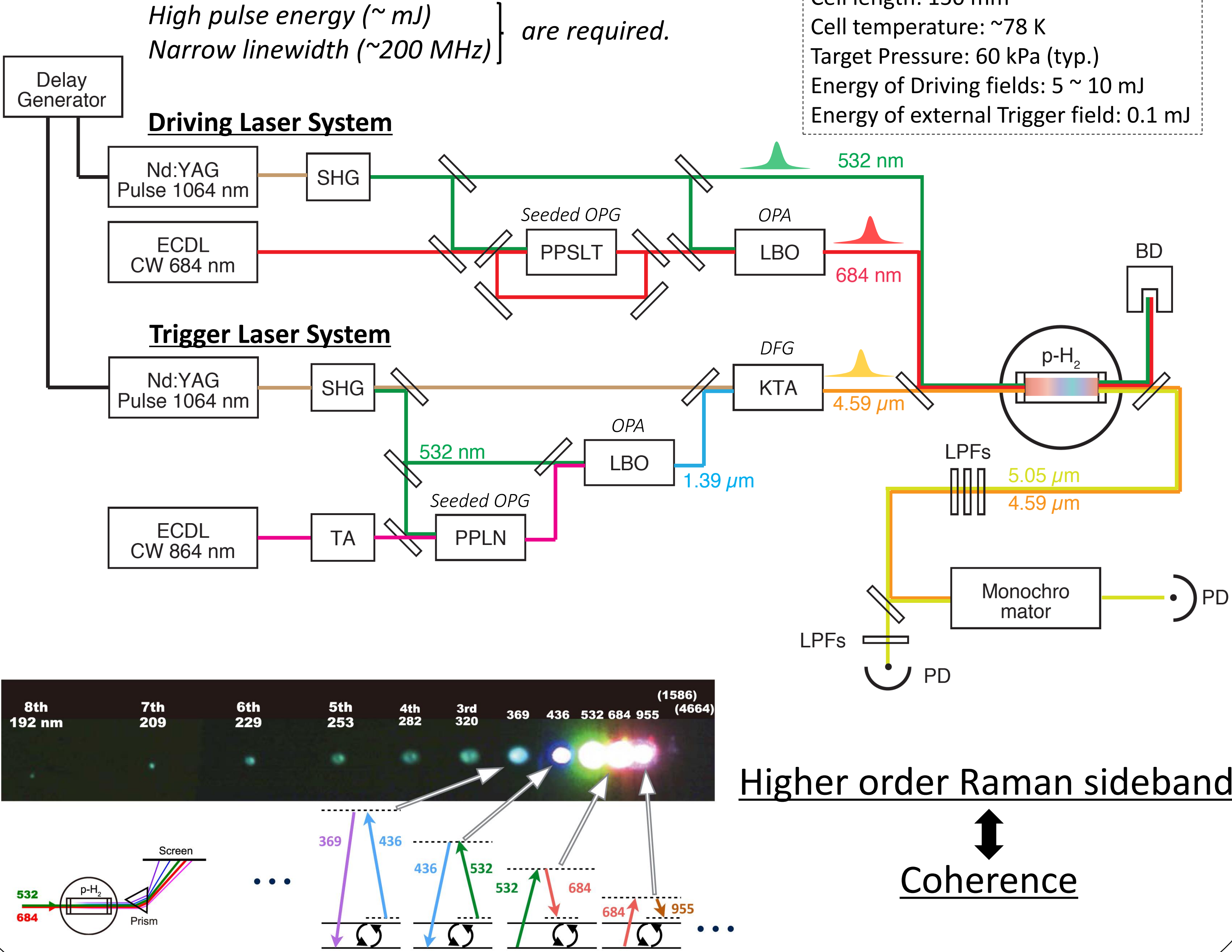


Validation of / Study on
Macro-coherent amplification using two-photon emission

Experimental Scheme

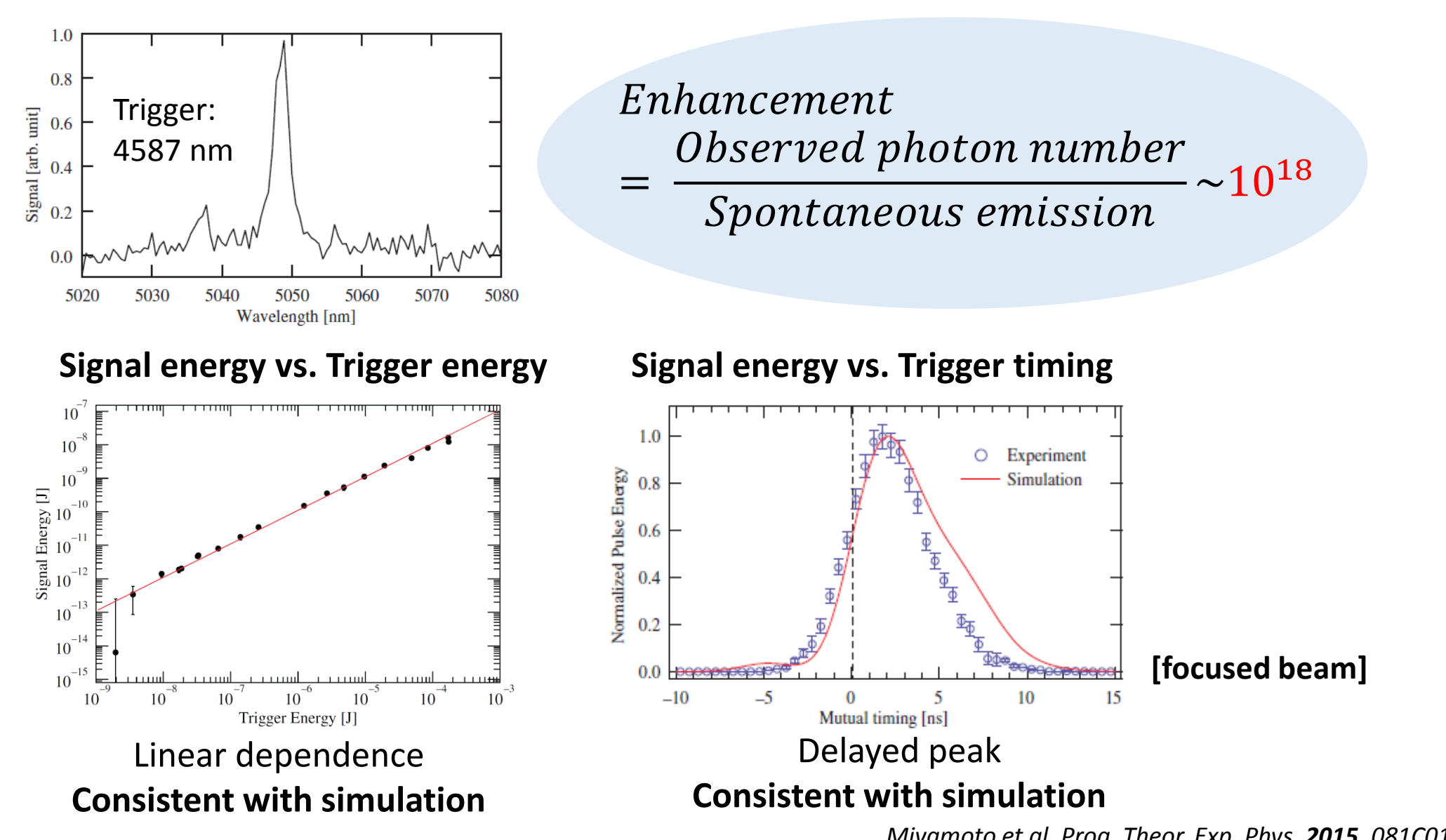


Experimental Setup

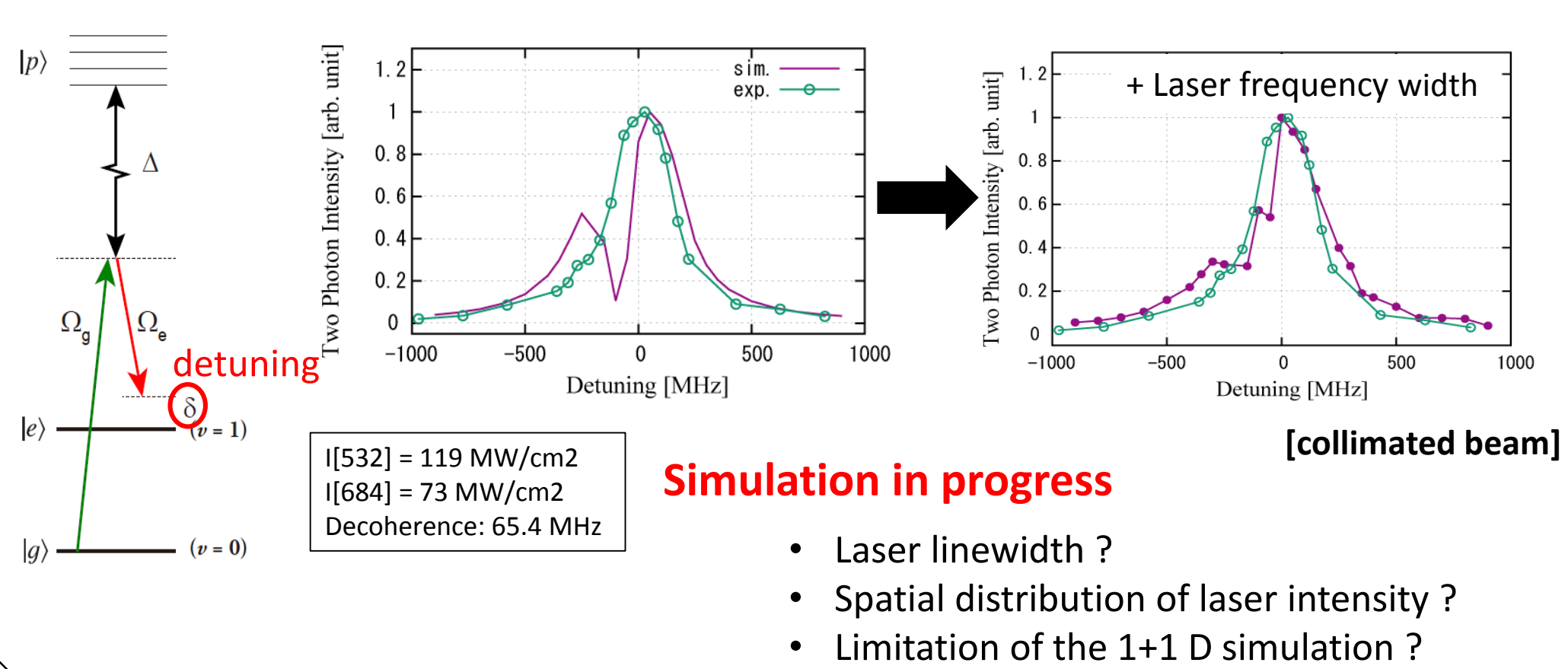


Results & Discussions

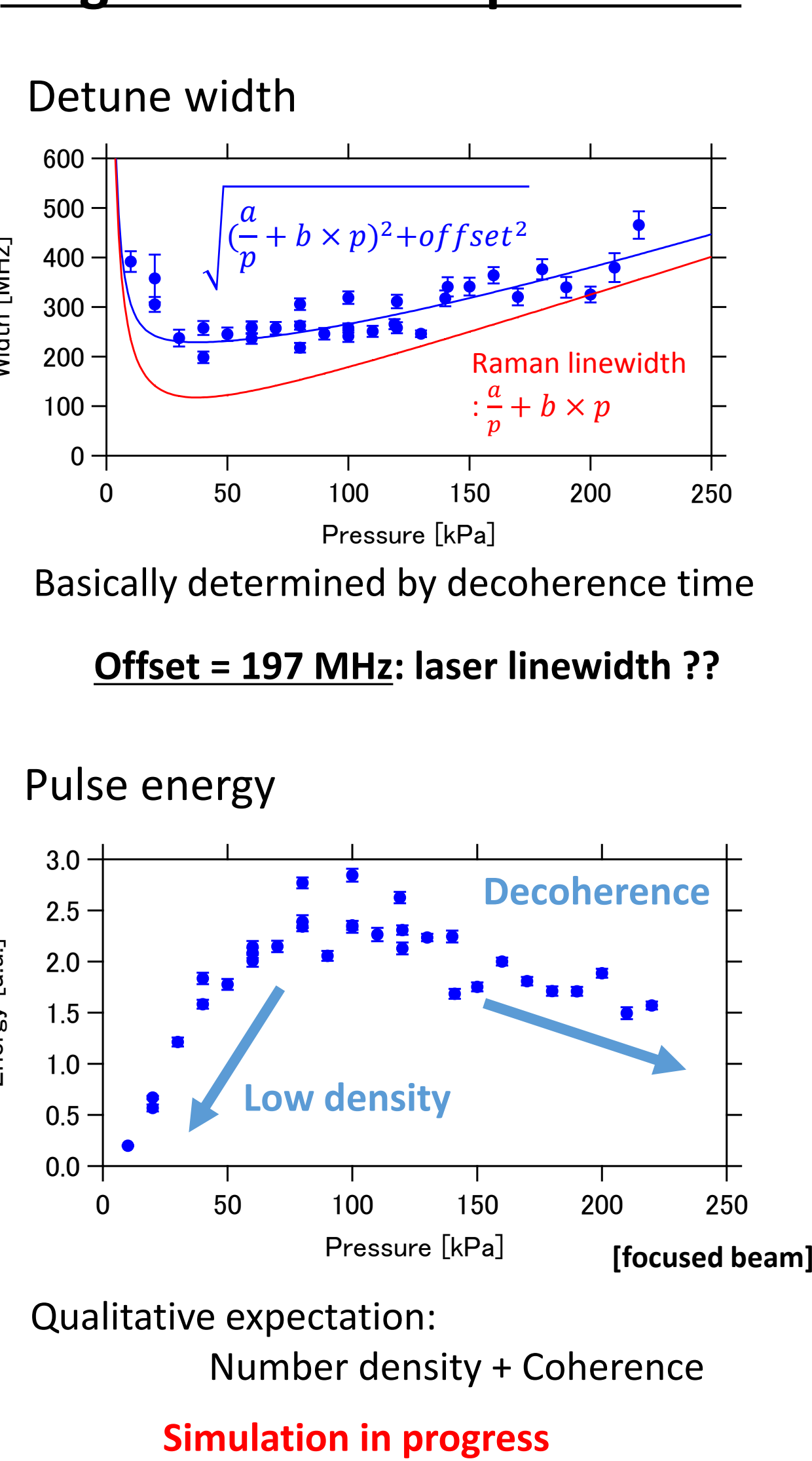
Externally triggered two-photon emission



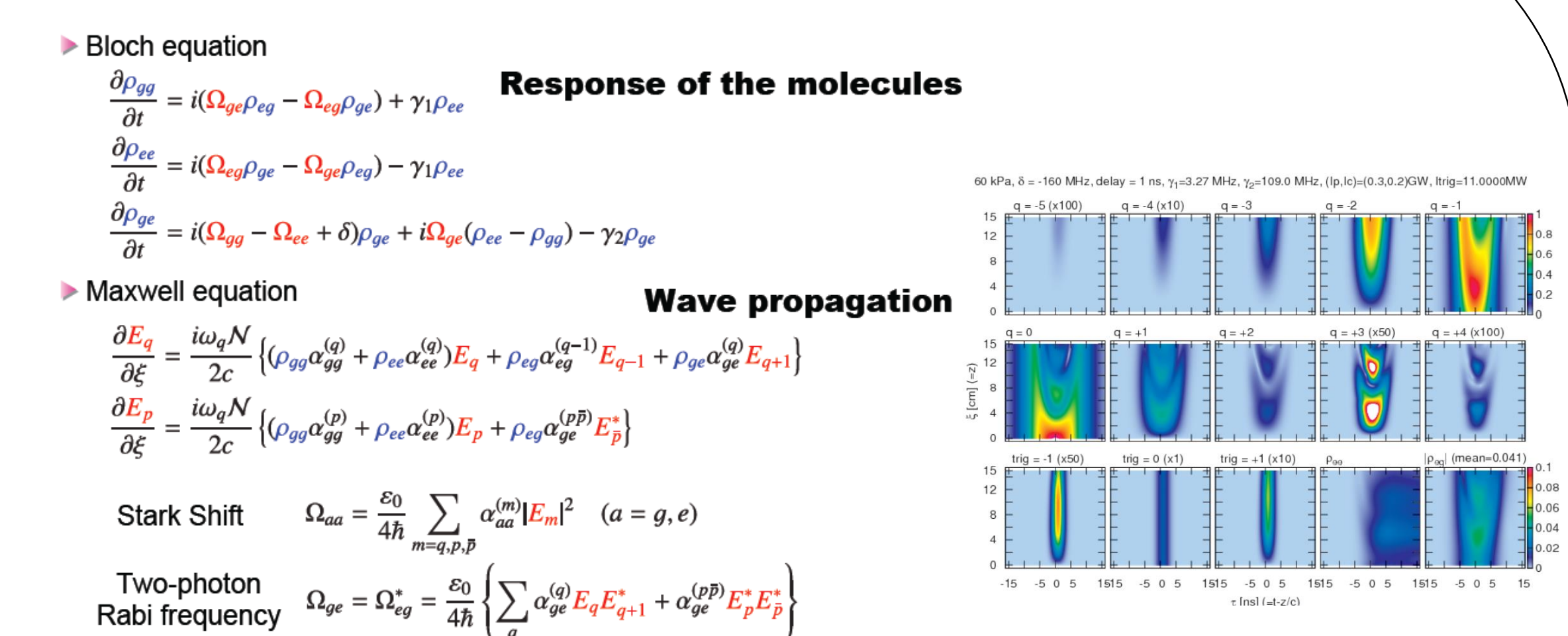
Detuning Dependence (Driving field frequency dependence)



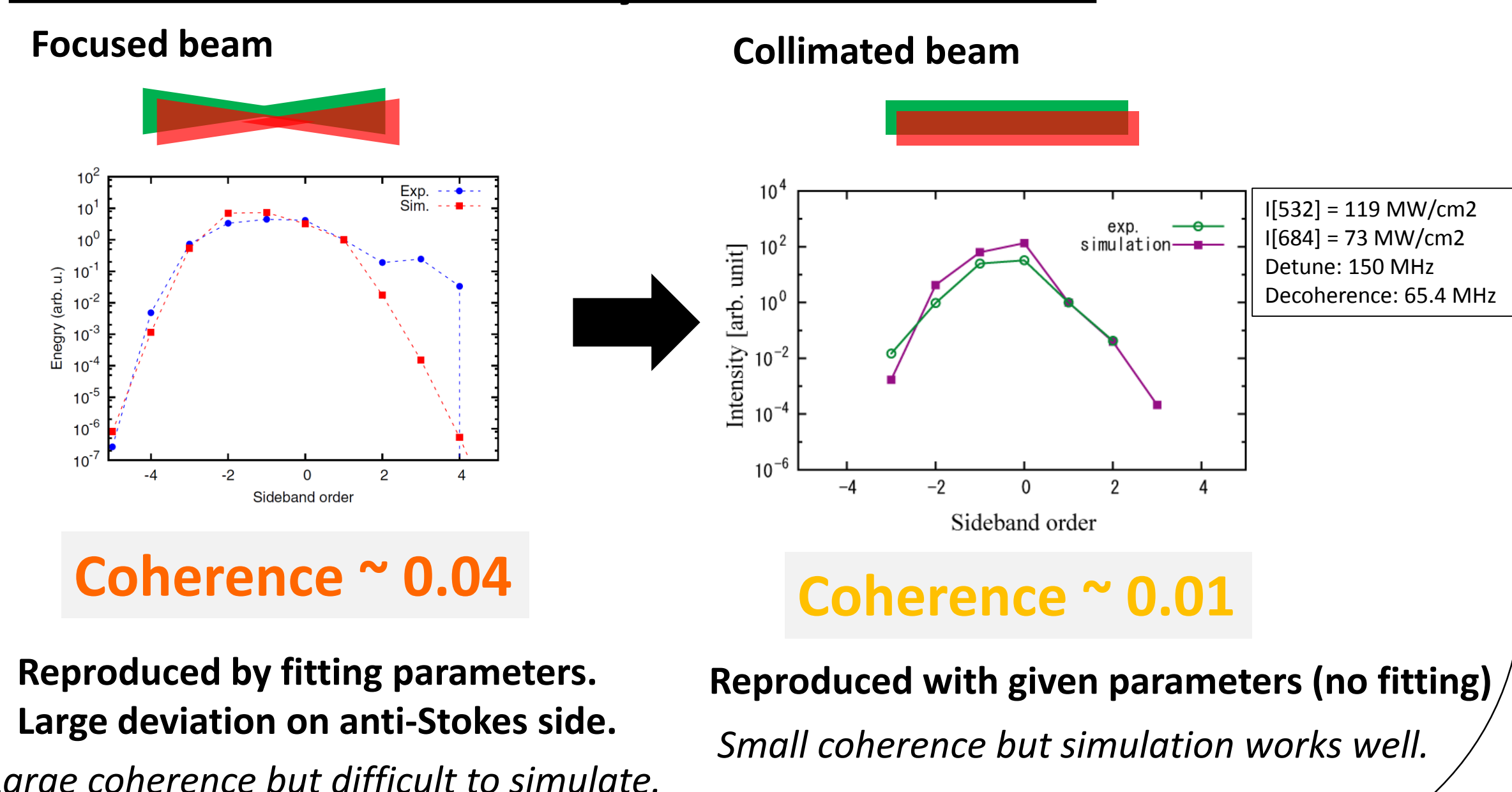
Target Pressure Dependence



1+1 Maxwell- Bloch Simulation



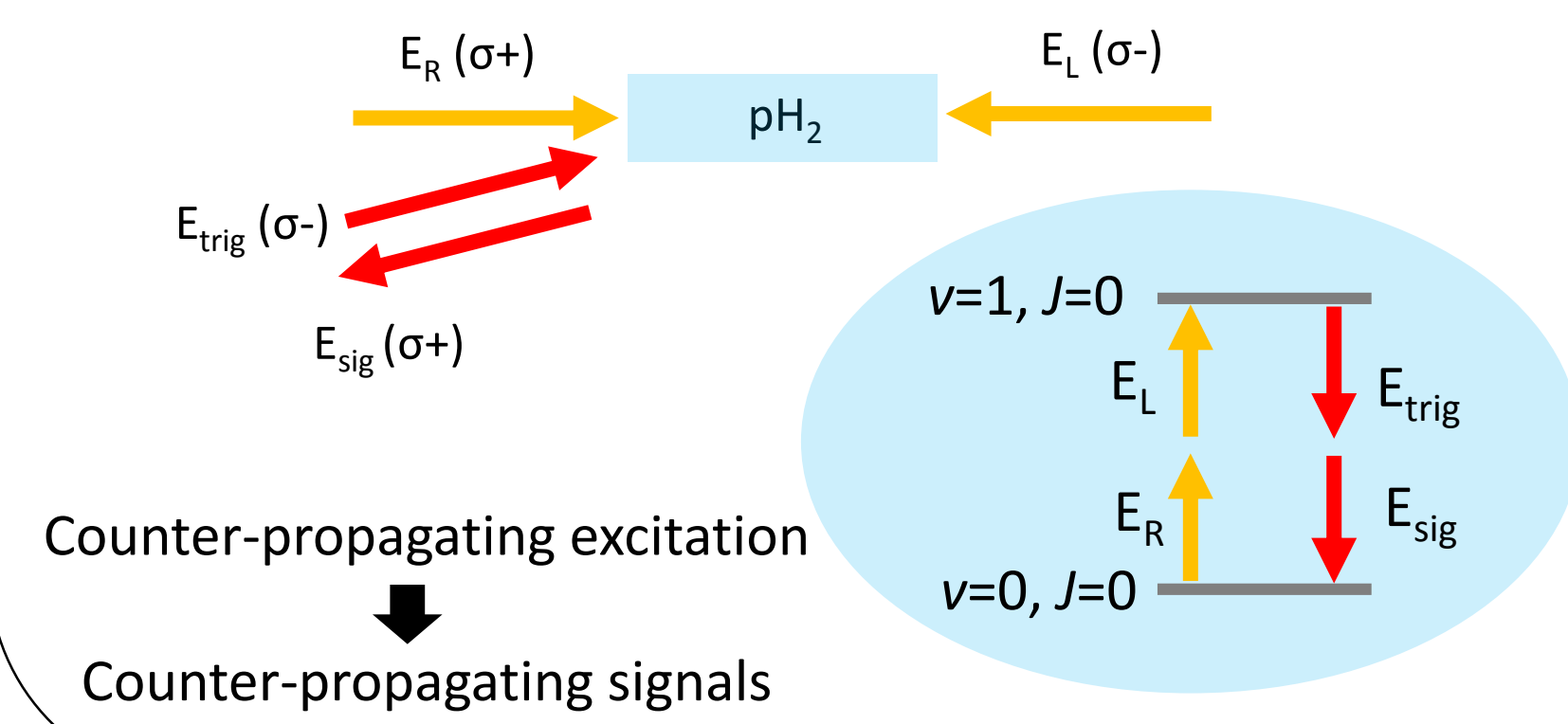
Coherence estimation by M. -B. Simulation



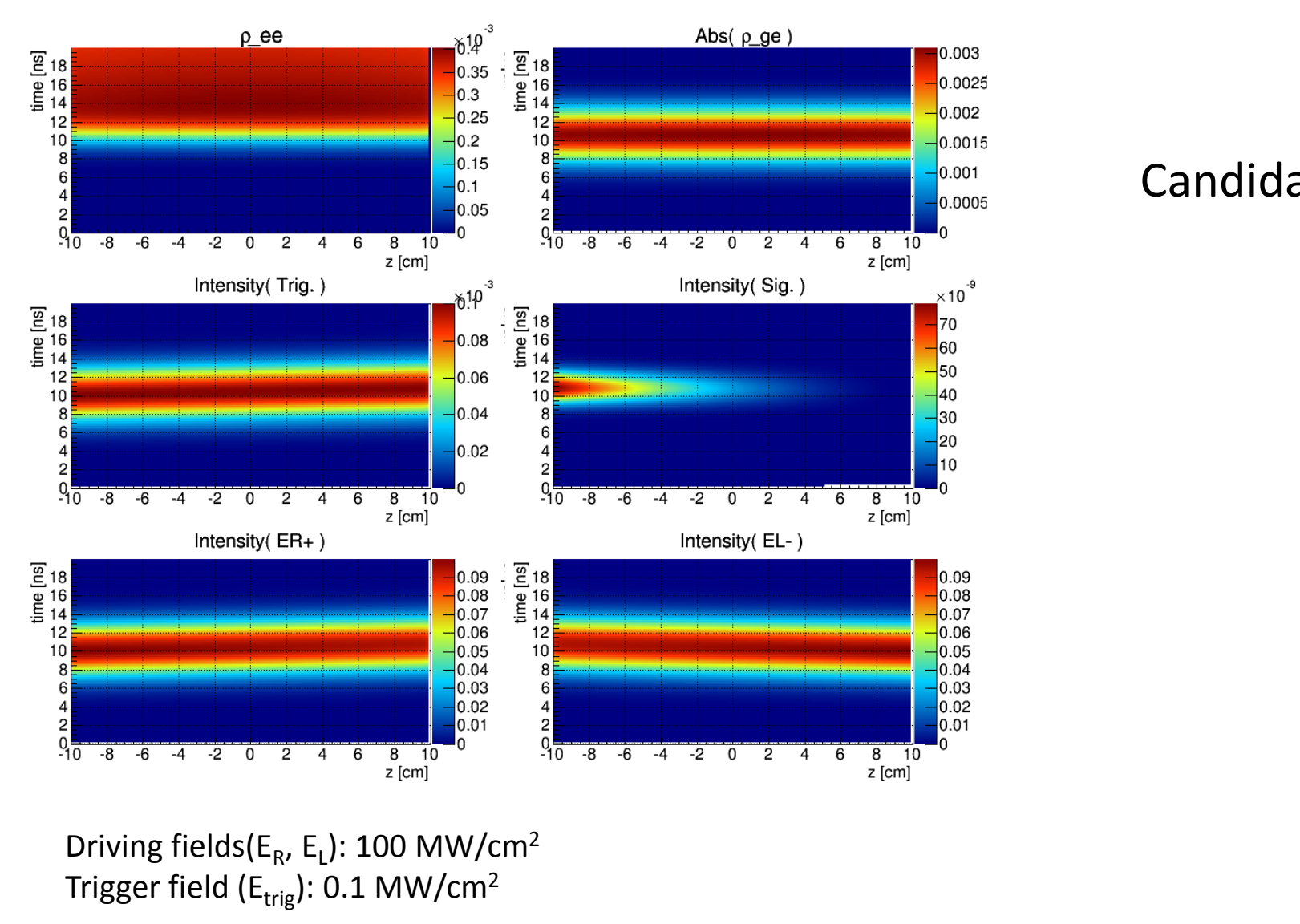
Future Plans

Counter-propagating two-photon emission (pH₂)

- Same excitation geometry as RENP
- No residual momentum after excitation



Preliminary simulation



New narrow linewidth high energy MIR source is required.

~ 10 mJ/pulse and ≤ 300 MHz linewidth

Candidate: Injection seeded ZGP OPO system

