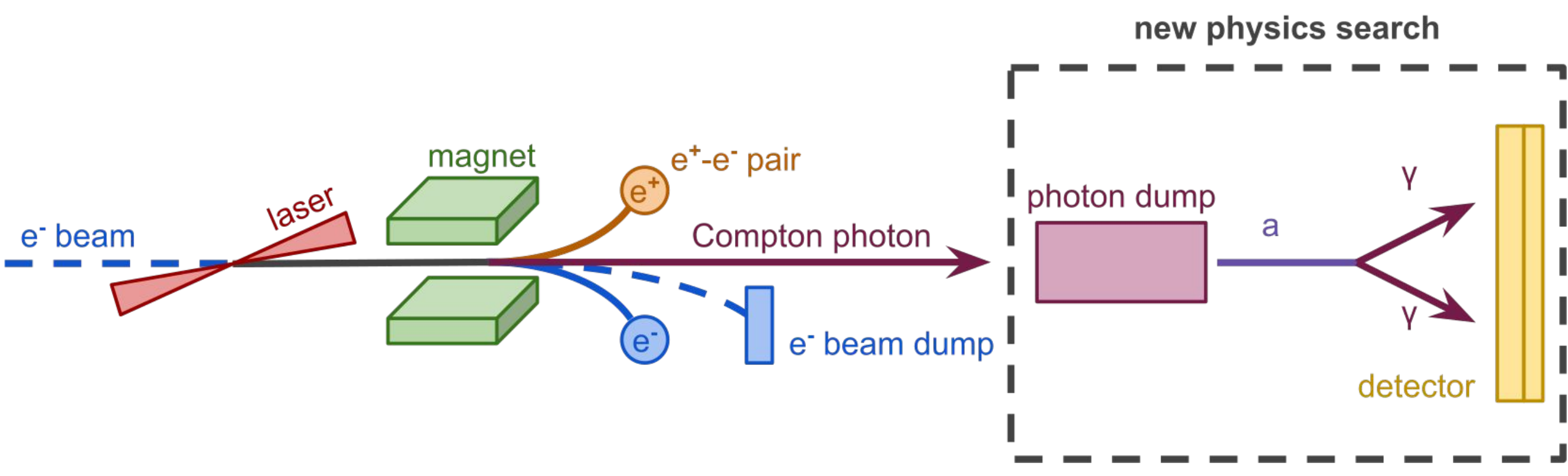


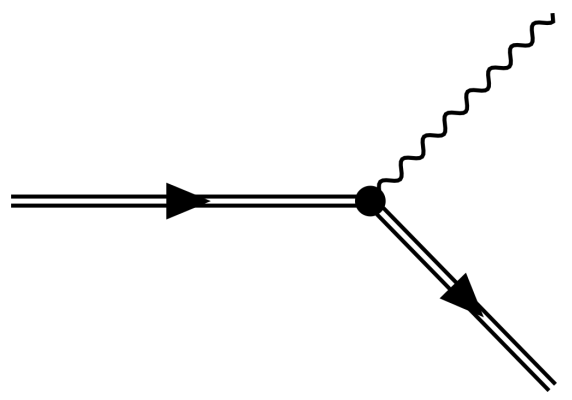
Electron-Laser Setup



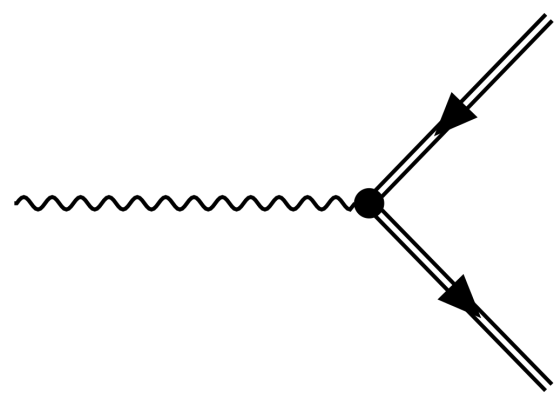
electrons	laser	photons
- 10 Hz bunches	- 1 Hz	- 3.5 γ/e^-
- up to 17.5 GeV	- 40 TW (phase-0)	- 1.7 γ/e^- (>1 GeV)
- 1.5×10^9 e^-/bunch	- 350 TW (phase-1)	

Physics Processes at LUXE

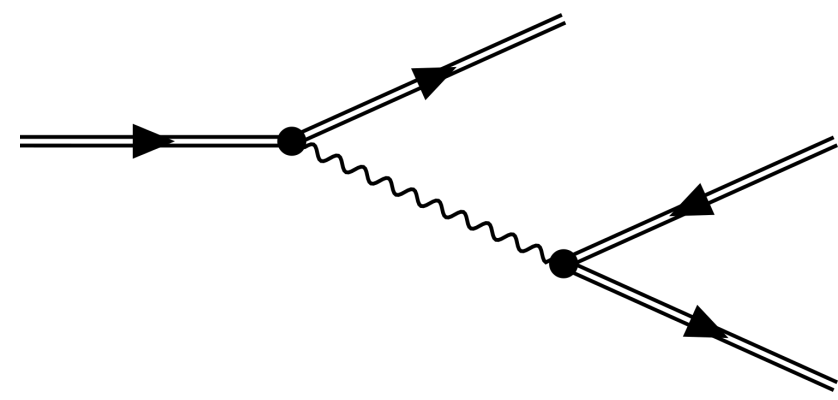
non-linear Compton
 $e^\pm \rightarrow e^\pm + \gamma$



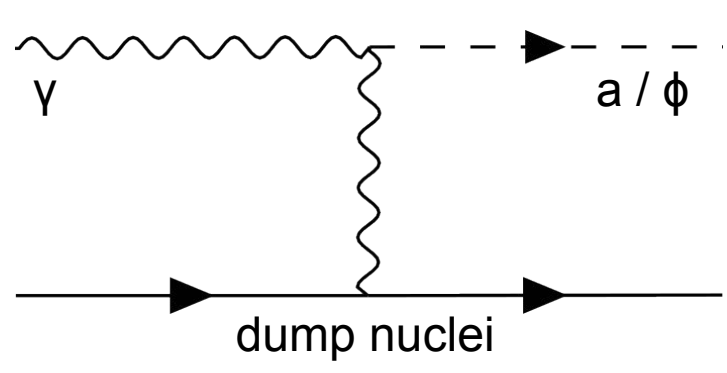
non-linear Breit-Wheeler
 $\gamma \rightarrow e^+ + e^-$



non-linear trident
 $e^\pm \rightarrow e^\pm + e^+ + e^-$

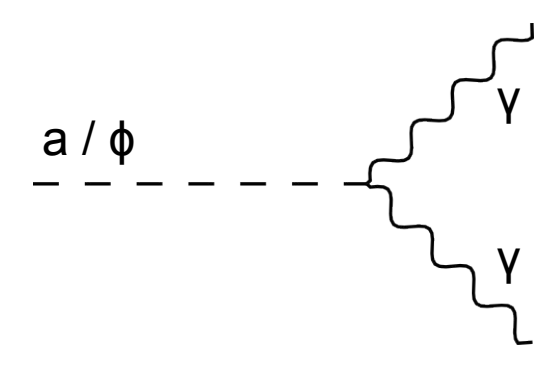


Primakoff production



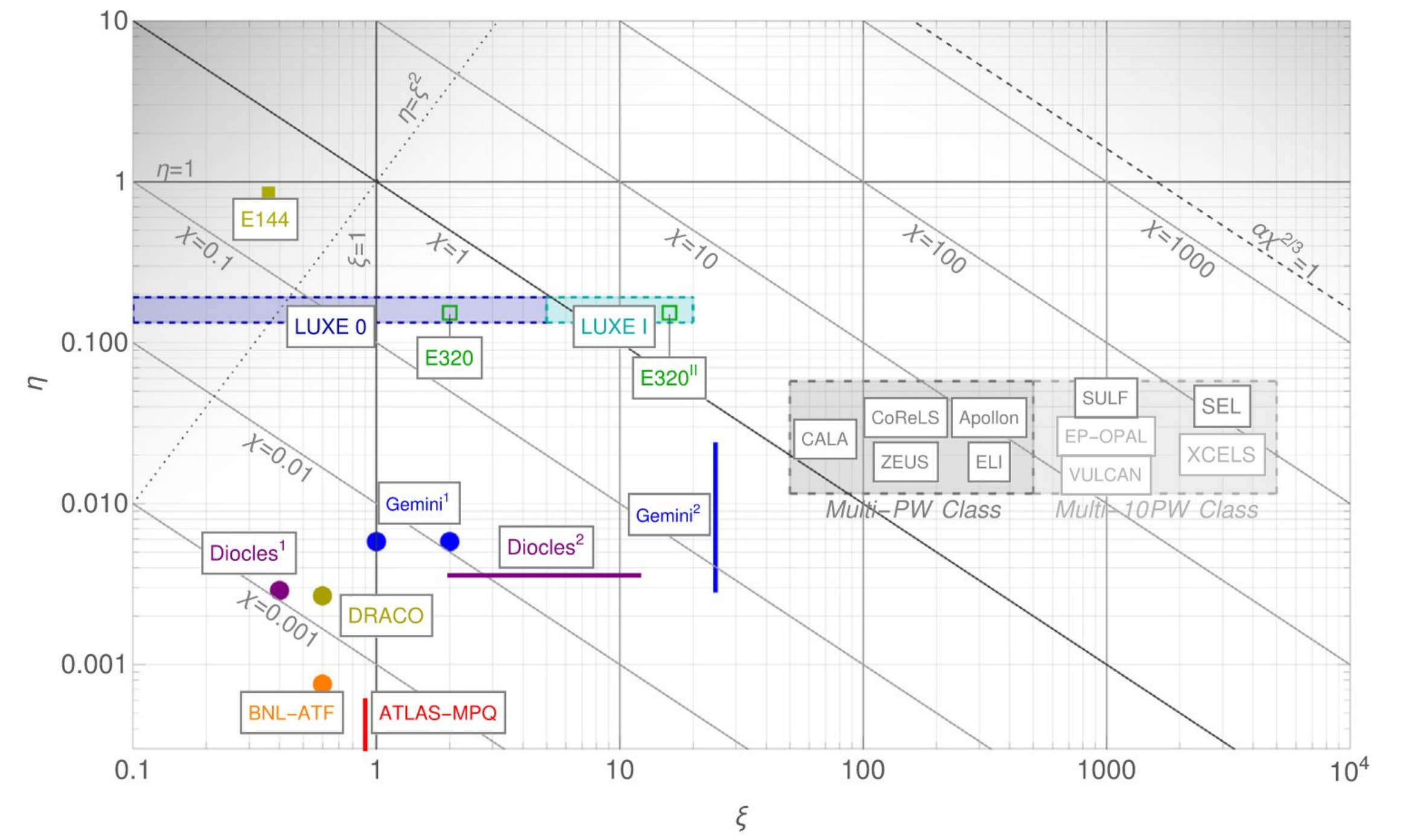
$$\mathcal{L}_a = \frac{a}{4\Lambda_a} F_{\mu\nu} \tilde{F}^{\mu\nu}$$

photon decay channel



$$\Gamma_{a \rightarrow 2\gamma} = \frac{m_a^3}{64\pi\Lambda_a^2}$$

Physical Quantities and Parameter Space

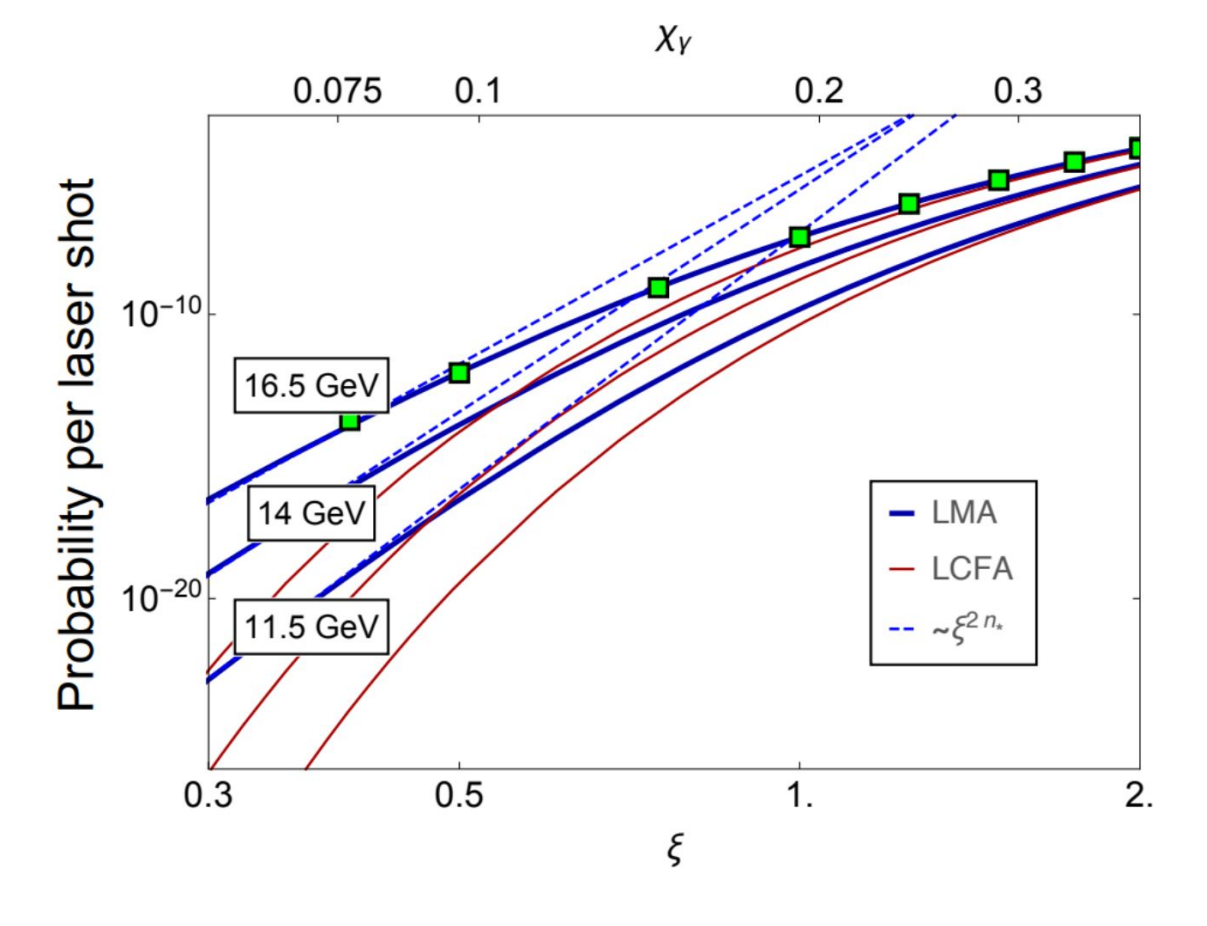
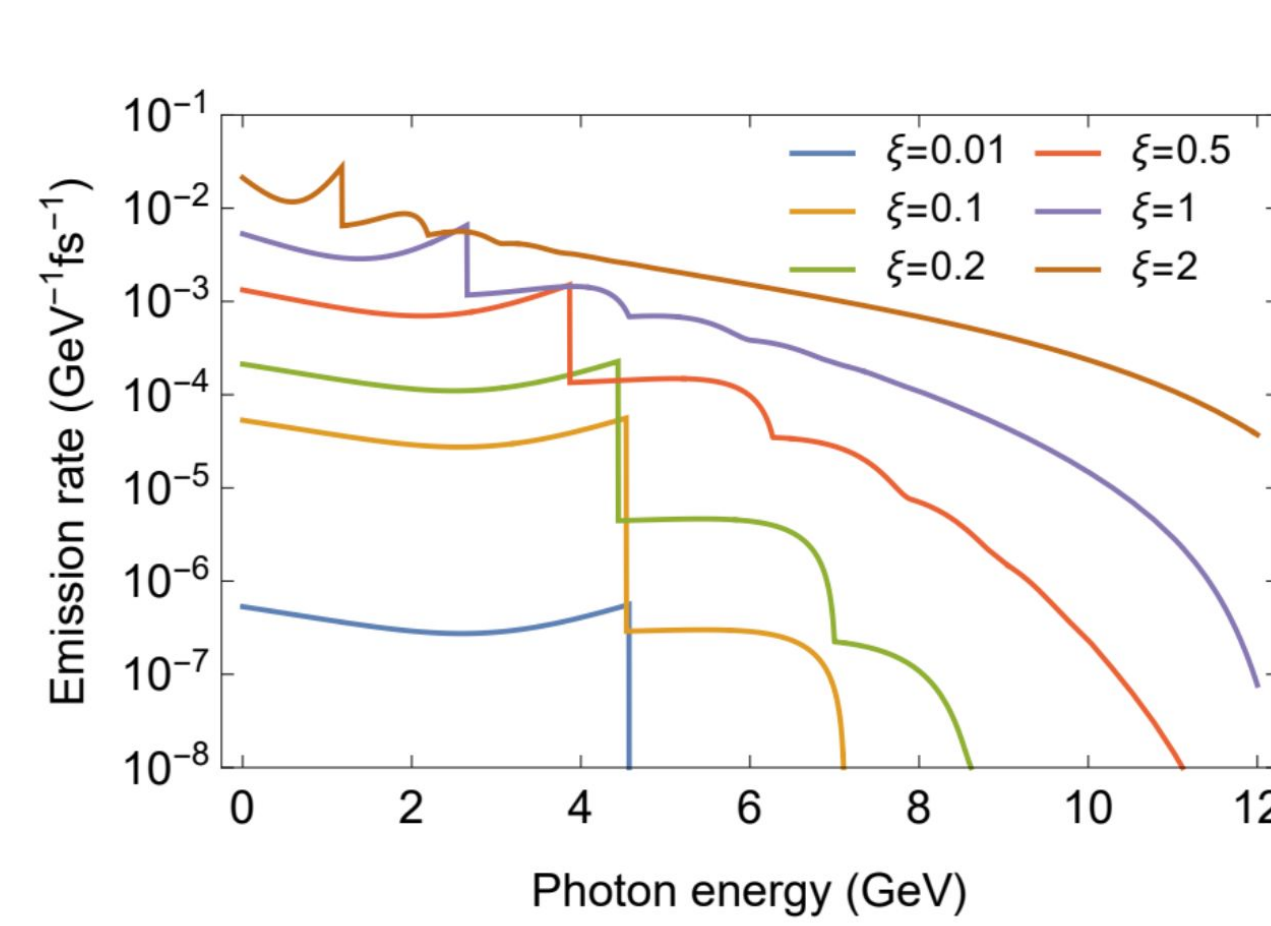


field intensity parameter

$$\xi = \sqrt{4\pi\alpha} \left(\frac{\epsilon_L}{\omega_L m_e} \right) = \frac{m_e \epsilon_L}{\omega_L \epsilon_c}$$

energy parameter

$$\eta = \gamma_0 \frac{\omega_L}{m_e} (1 + \cos(\theta))$$



LUXE

Exploring New Physics with the Optical Dump at LUXE and Prospects for Future Facilities

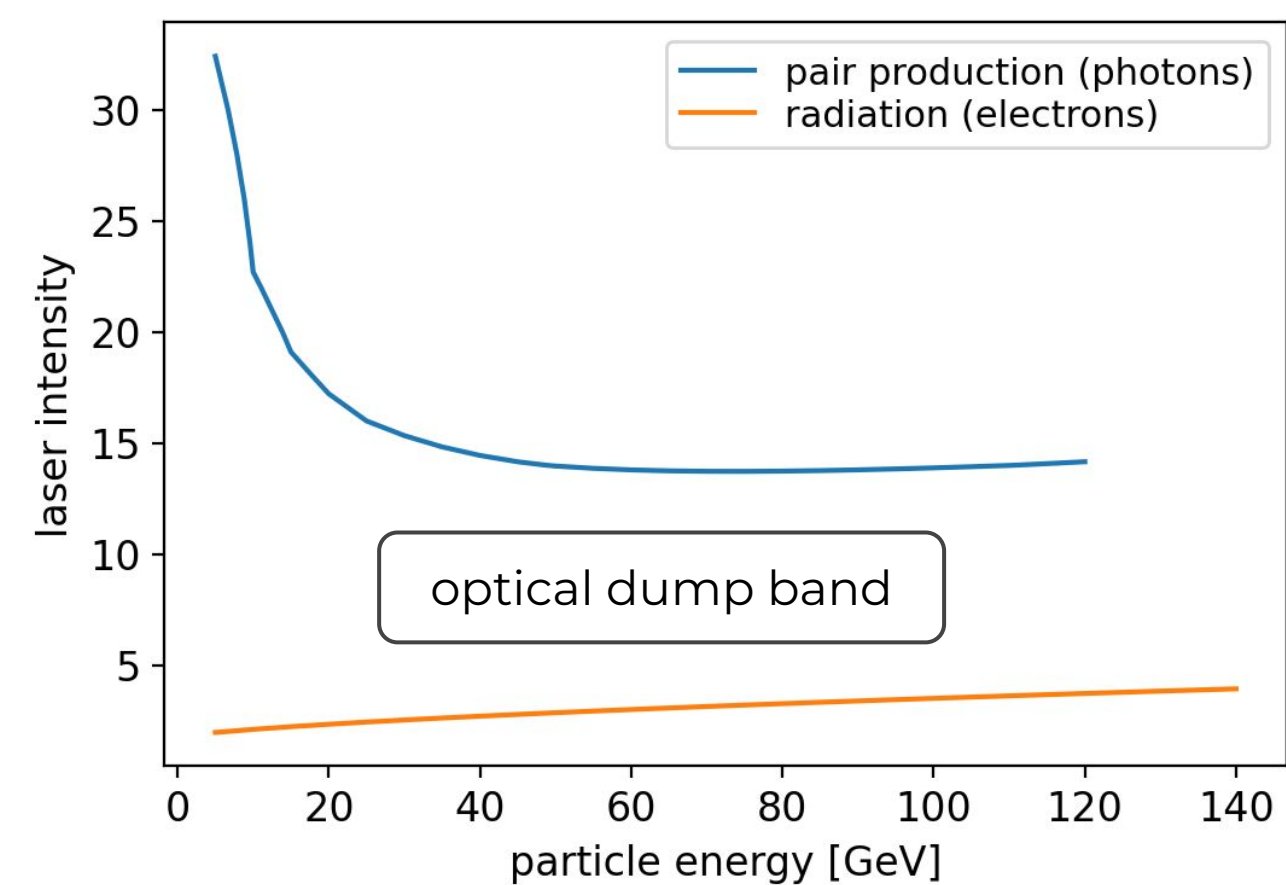
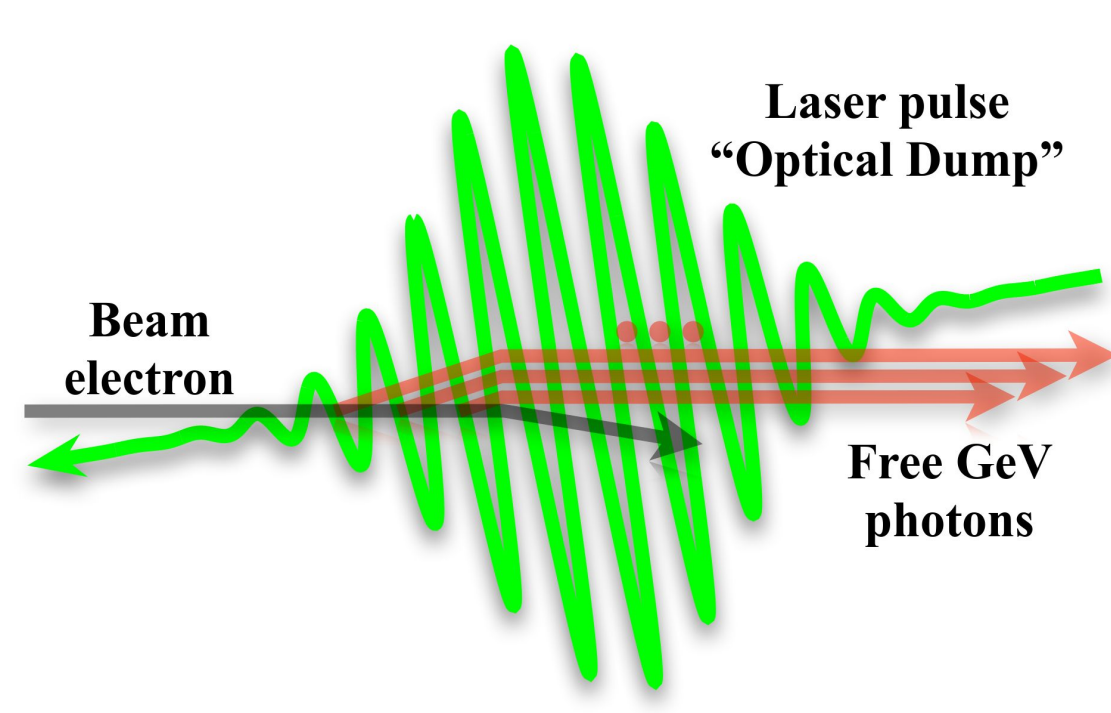
Ivo Schulthess on behalf of the LUXE collaboration
ivo.schulthess@desy.de



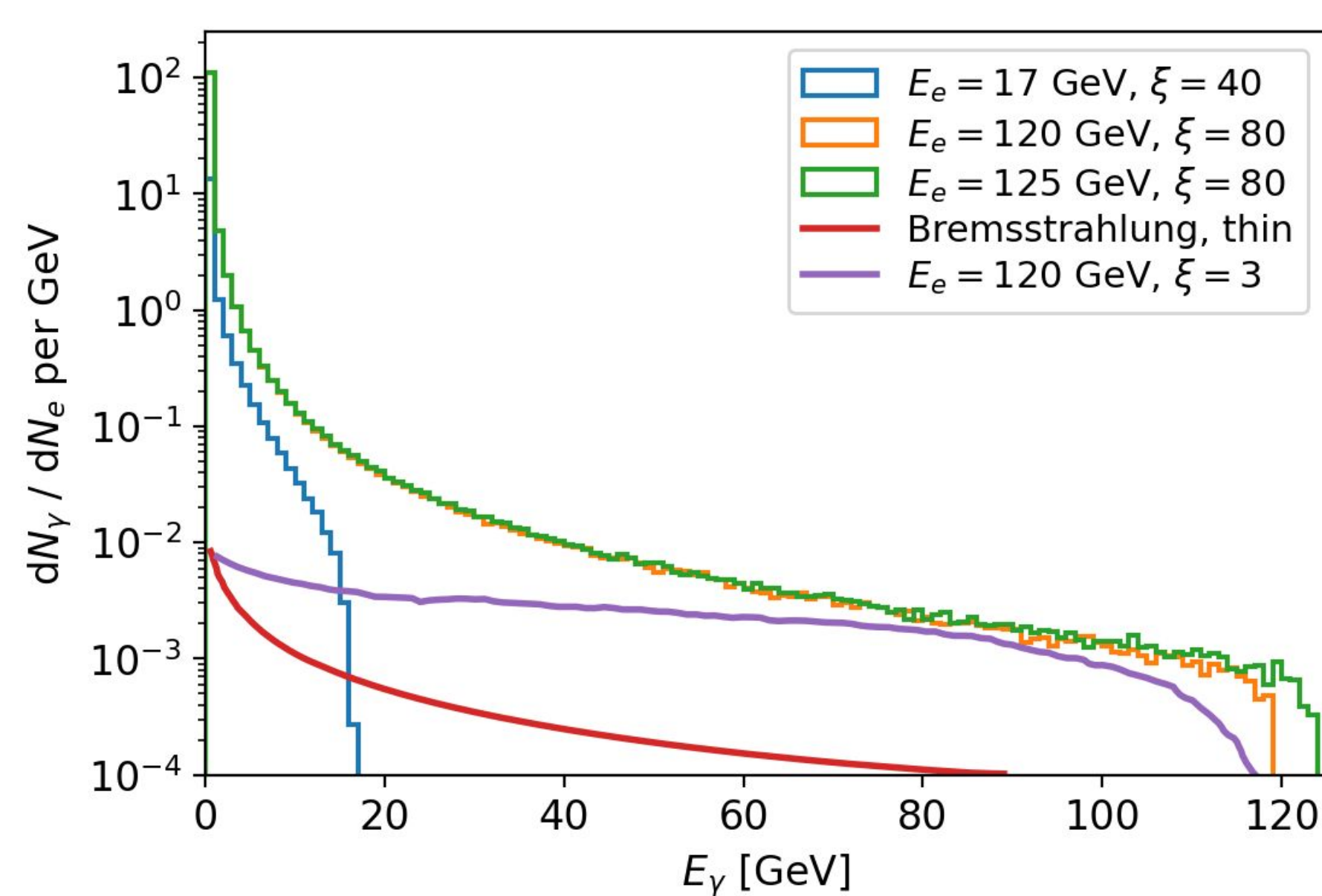
Optical Dump

New Physics

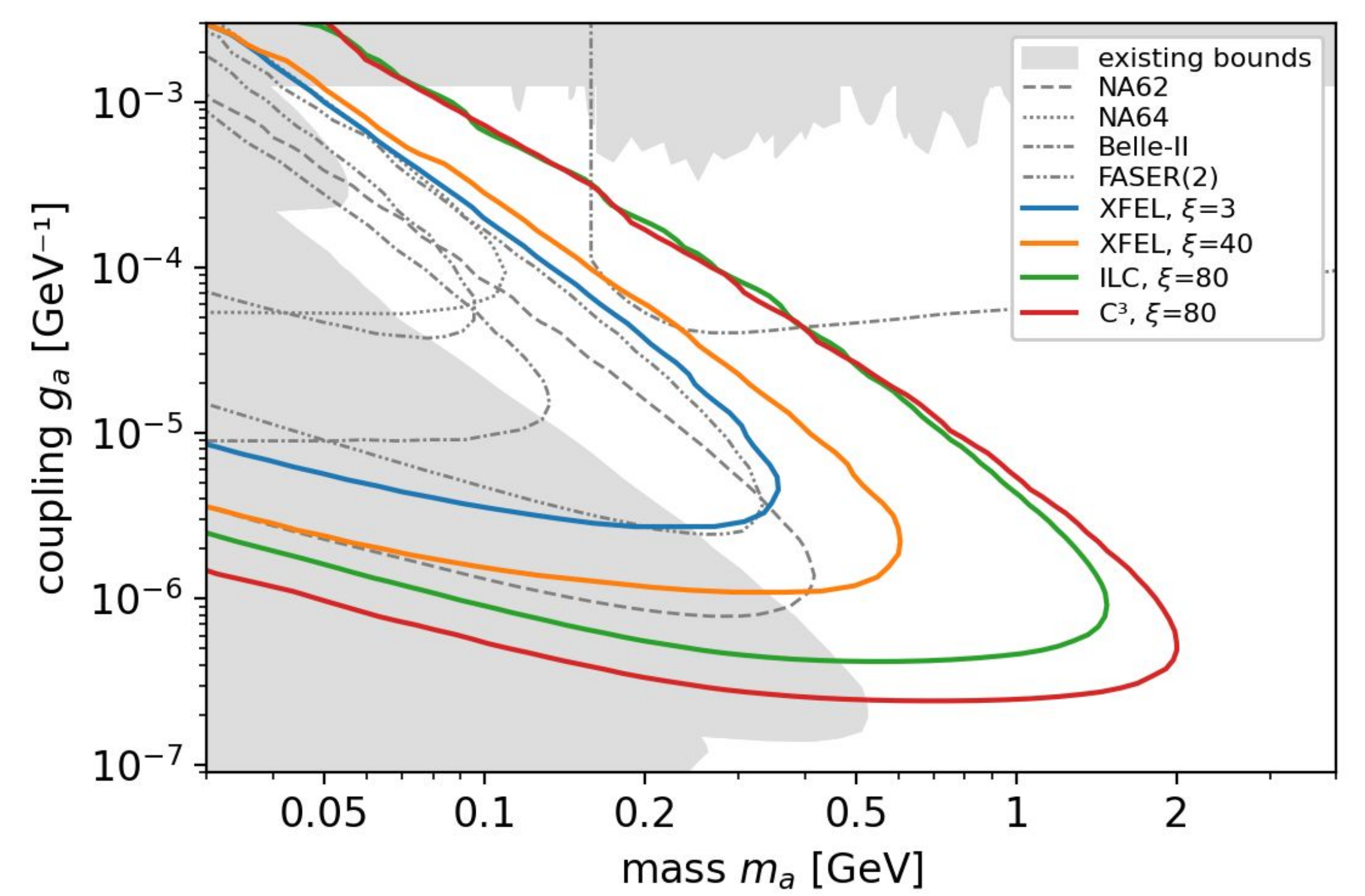
- laser oscillation
 $1/\omega_L \approx 0.4$ fs
- Compton scattering
 $\tau_\gamma \approx \mathcal{O}(10)$ fs
- laser pulse
 $t_L \approx \mathcal{O}(10 - 200)$ fs
- pair production
 $\tau_{ee} \approx \mathcal{O}(10^4 - 10^6)$ fs



$$1/\omega_L \ll \tau_\gamma \lesssim t_L \ll \tau_{ee}$$



Phase-Space Coverage



$$\mathcal{L}_{\text{eff}} = N_e N_{bx} \frac{9\rho X_0}{7Am_0}$$

ILC:	$\mathcal{L}_{\text{eff}} = 28.5 \text{ fb}^{-1}$
EU.XFEL:	$\mathcal{L}_{\text{eff}} = 4.3 \text{ fb}^{-1}$
C ³ :	$\mathcal{L}_{\text{eff}} = 212.0 \text{ fb}^{-1}$
FCC-ee (100 Hz):	$\mathcal{L}_{\text{eff}} = 159.6 \text{ fb}^{-1}$
CEPC (100 Hz):	$\mathcal{L}_{\text{eff}} = 222.2 \text{ fb}^{-1}$

[1] Abramowicz, H. et al., *Conceptual Design Report for the LUXE Experiment*. Eur. Phys. J. Spec. Top. **230**, 2445–2560 (2021). DOI: 10.1140/epjs/s11734-021-00249-z

[2] Fedotov, A. et al., *Advances in QED with intense background fields*. Phys. Rep. **1010**, 1–138 (2023). DOI: 10.1016/j.physrep.2023.01.003

[3] Bai, Z. et al., *New physics searches with an optical dump at LUXE*. Phys. Rev. D **106**, 115034 (2022). DOI: 10.1103/physrevd.106.115034

