

Investigation of radiation reaction at ELI-NP

K. Seto¹, T. Moritaka², K. Homma^{3,4}, Y. Nakamiya¹,

J. F. Ong¹, L. D'Alessi¹ and O. Tesileanu¹

¹ *Extreme Light Infrastructure - Nuclear Physics (ELI-NP)/ Horia Hulubei National Institute for R&D in Physics and Nuclear Engineering, Ilfov, Romania*

² *National Institute for Fusion Science, Gifu, Japan*

³ *Graduate School of Science, Hiroshima Univ., Hiroshima, Japan*

⁴ *International Center for Zetta-watt Science and Technology, École Polytechnique, France*

In the rapid development of high-power and high-intensity lasers in the world, the maximum laser power and intensity will reach $O(10\text{PW}-10^{23}\text{W}/\text{cm}^2)$ soon. Extreme Light Infrastructure – Nuclear Physics (ELI-NP) is one of the research centers which has the 2 arms of the 10PW lasers to create such extremely high-intensity light, and the electron LINAC up to 720MeV to create gamma photons of $O(\sim 19.5\text{MeV})$ via the inverse Compton scattering [1].

Radiation reaction (RR), the back-reaction acting on a radiating electron, has become important in laser-plasma science due to the construction of these high-intensity lasers. One of its typical predictions is that more than 80% of the electron's energy is lost in RR in the case of beam parameters similar to the ones of ELI-NP [2]. The work was performed in purely classical dynamics, however, the importance of the quantum corrections depending on laser intensity has been recently suggested [3]. Theoretical models with quantum corrections have been proposed by many authors. To investigate this, we plan to examine the RR effect by the head-on collision between the high-energy electrons of 720MeV from LINAC and the high-intensity laser ($>10^{22}\text{W}/\text{cm}^2$) at ELI-NP [4].

In this presentation, we will give the schematic idea of the RR experiment at ELI-NP. In addition, we will also show the theoretical model of RR developed, "RR acting on a relativistic and Brownian scalar electron", as the quantization of the Lorentz-Abraham-Dirac equation in classical dynamics [5].

[1] ELI-NP: <https://www.eli-np.ro/>

[2] J. Koga, Phys. Rev. E **70**,046502 (2004).

[3] For example, K. Seto, Prog. Theor. Exp. Phys. **2015**, 103A01 (2015).

[4] K. Homma, et. al., Rom. Rep. Phys. **68**, Supplement, S233 (2016).

[5] K. Seto, arXiv:1603.03379v5 (2017).