Eur. Phys. J. D **62**, 457 (2011)
DOI: 10.1140/epjd/e2011-10511-0

THE EUROPEAN PHYSICAL JOURNAL D

Comment

Comment on "Proposal for Raman X-ray free electron laser"

by Ph. Balcou, Eur. Phys. J. D 59, 525–537 (2010)

A. Zholents[1,a] and M. Zolotorev[2]

[1] Advanced Photon Source, Argonne National Laboratory, 9700 South Cass Avenue, IL 60439, Argonne, USA
[2] Lawrence Berkeley National Laboratory, 1 Cyclotron Road, CA 94720, Berkeley, USA

Received 15 September 2010
Published online 15 April 2011 –

Equation (13) in this paper defines the force experienced by the electron moving in z direction with velocity v_z due to the X-ray wave propagating in z direction with electric field E_1 pointing in y direction and magnetic field B_1 pointing in x direction as

$$\vec{F}_1(t) = -eE_1 \cos(\omega_1 t - k_1 z)\vec{e}_y. \tag{1}$$

In our opinion calculating this force one should also include the impact of the X-ray wave's magnetic field and obtain

$$\begin{aligned}\vec{F}_1(t) &= -e\left(E_1 - \frac{v_z}{c}B_1\right)\cos(\omega_1 t - k_1 z)\vec{e}_y \\ &\approx -\frac{eE_1}{2\gamma^2}\cos(\omega_1 t - k_1 z)\vec{e}_y.\end{aligned} \tag{2}$$

Here c is the speed of light and γ is the electron relativistic factor. In result one would need to change E_1 to $E_1/2\gamma^2$ in all the following equations in the cited paper (except wave propagation equations, Eqs. (23) and (34)). We believe that similar omission of the impact of the magnetic field appears in equation (28). Consequently, the formula for the gain (Eq. (37) in the cited paper) should also include the factor $1/2\gamma^2$. This is a rather significant modification considering that relativistic electrons with values of γ ranging from approximately 20 to approximately 300 are used in the numerical examples.

[a] e-mail: azholents@aps.anl.gov