Effect of the temporal laser pulse asymmetry on pair production processes during intense laser-electron scattering

C I Hojbota, Hyung Taek Kim, Chul Min Kim, V B Pathak and Chang Hee Nam, Plasma Phys. Control. Fusion 60 (2018)
Notebook: Óscar Amaro, November 2022 @ GoLP-EPP
Contact: oscar.amaro@tecnico.ulisboa.pt

Introduction

In this notebook we reproduce some results from the paper.

Table 1

In[1550]:=
```
(* table 1 *)
Clear[τ12, τ12r, τ12f]
τ12 = 42;
τ12r = {36, 31.5, 21.5, 10.5, 6};
τ12f = {6, 10.5, 21, 31.5, 36};

(* S *)
(τ12r - τ12f) / τ12 // N
```

Out[1554]=
```
{0.714286, 0.5, 0.0119048, -0.5, -0.714286}
```

Figure 2

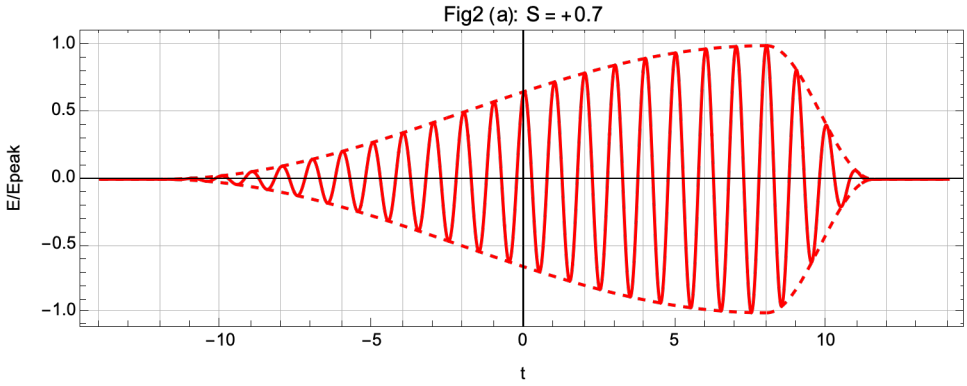
In[1555]:=
```
Clear[T1, T2, τ12r, τ12f, τ12, sol, S, c, λ, ω0, T, tpeak]

sol = Solve[{τ12f == τ12 - τ12r, S == (τ12r - τ12f) / τ12}, {τ12r, τ12f}]
τ12r = sol[[1, 1, 2]]
τ12f = sol[[1, 2, 2]]

(* physical parameters *)
c = 299 792 458; (*[m/s]*)
λ = 0.8 × 10^-6; (*[m]*)
ω0 = 2 π c / λ; (*[s-1]*)
T = 2 π / ω0; (*[s]*)
τ12 = 42;(*[fs] as stated after eq 4*)

S = +0.7;
T1 = 6 τ12r ;
T2 = 6 τ12f;

Tt[t_] := Piecewise[{{Cos[t/T1]^2 HeavisideTheta[π/2 T1 + t], t < 0},
    {Cos[t/T2]^2 HeavisideTheta[π/2 T2 - t], t > 0}}]

tpeak = 8;
Plot[{Tt[2 π (tt - tpeak) T 10^15] Cos[ω0 tt T], Tt[2 π (tt - tpeak) T 10^15],
  -Tt[2 π (tt - tpeak) T 10^15]}, {tt, -14, +14}, Frame → True,
 FrameLabel → {"t", "E/Epeak"}, PlotLabel → "Fig2 (a): S = +0.7",
 PlotStyle → {Red, {Red, Dashed}, {Red, Dashed}}, AspectRatio → 1 / 3,
 GridLines → {Table[x, {x, -14, 14, 2}], {-1, -0.5, 0, 0.5, 1}}, ImageSize → 500]
```

Out[1556]= $\left\{\left\{\tau12r \to \frac{1}{2}\ (\tau12 + S\ \tau12),\ \tau12f \to \frac{1}{2}\ (\tau12 - S\ \tau12)\right\}\right\}$

Out[1557]= $\frac{1}{2}\ (\tau12 + S\ \tau12)$

Out[1558]= $\frac{1}{2}\ (\tau12 - S\ \tau12)$

Out[1565]=



In[1566]:=
```
Clear[T1, T2, τ12r, τ12f, τ12, sol, S, c, λ, ω0, T, tpeak]

sol = Solve[{τ12f == τ12 - τ12r, S == (τ12r - τ12f) / τ12}, {τ12r, τ12f}];
τ12r = sol[[1, 1, 2]];
τ12f = sol[[1, 2, 2]];

(* physical parameters *)
c = 299 792 458; (*[m/s]*)
λ = 0.8 × 10^-6; (*[m]*)
ω0 = 2 π c / λ; (*[s-1]*)
T = 2 π / ω0; (*[s]*)
τ12 = 42; (*[fs] as stated after eq 4*)

S = -0.7;
T1 = 6 τ12r;
T2 = 6 τ12f;

Tt[t_] := Piecewise[{{Cos[t / T1]^2 HeavisideTheta[π/2 T1 + t], t < 0},
    {Cos[t / T2]^2 HeavisideTheta[π/2 T2 - t], t > 0}}]

tpeak = 8;
Plot[{Tt[2 π (tt + tpeak) T 10^15] Cos[ω0 tt T], Tt[2 π (tt + tpeak) T 10^15],
  -Tt[2 π (tt + tpeak) T 10^15]}, {tt, -14, +14}, Frame → True,
 FrameLabel → {"t", "E/Epeak"}, PlotLabel → "Fig2 (b): S = -0.7",
 PlotStyle → {Blue, {Blue, Dashed}, {Blue, Dashed}}, AspectRatio → 1 / 3,
 GridLines → {Table[x, {x, -14, 14, 2}], {-1, -0.5, 0, 0.5, 1}}, ImageSize → 500]
```

Out[1575]=