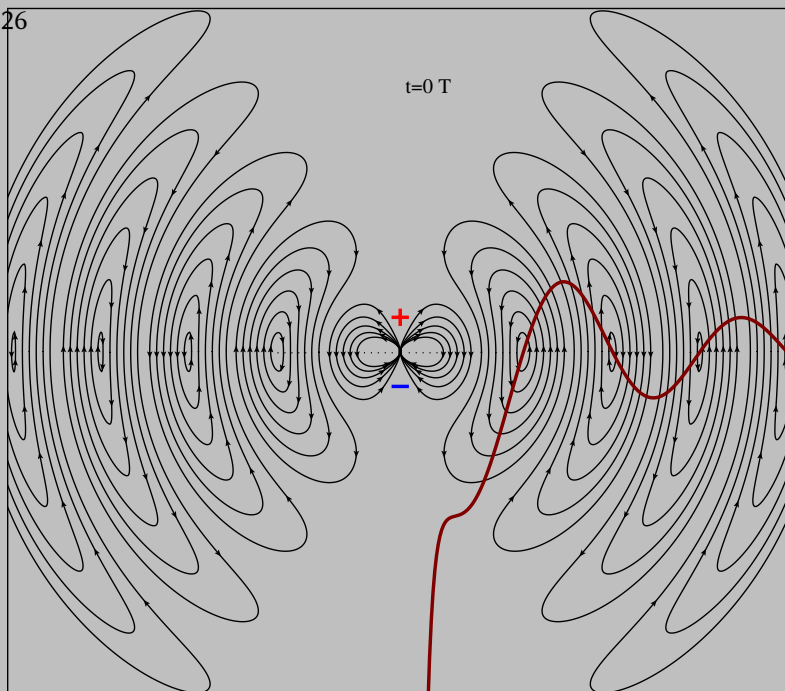


# PSTricks

## pst-hertz: Representation of the electric field radiated by a Hertzian dipole

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## 1 Introduction

The files can be run with `lualatex`, which creates directly the pdf, or with the sequence `latex→dvips→ps2pdf`. The last one is to preferred for animations which needs heavy calculations.

**pst-hertz-doc** The main documentation

**pst-hertz-animate** The main animation

**pst-hertz-text-0** Base file for a gif-animation with

```
\psHertzDipole[t=\i,lambda=150,Ez=false,linewidth=1pt,h=0.5,FillSpace,HSBFill,DrawLines]
```

**pst-hertz-text-1** Base file for a gif-animation with additional markers and

```
\psHertzDipole[t=\i,linewidth=1.2pt,linecolor=orange,doublecolor={rgb}{0 0.5 0}},BiColorLines]
```

**pst-hertz-text-2** Base file for a gif-animation with

```
\psHertzDipole[t=\i,FieldLines=8,lambda=100,Ez=false,linewidth=0.5pt,DrawArrows=false,h=1,FillSpace,DrawArrows]
```

## 2 Options for the `\psHertzDipole` command in the *pst-hertz* package

Many authors have created visualizations of the electromagnetic field radiated by a Hertzian dipole; the version by Raimund V. Girwidz is the most comprehensive. [1] The objectives of the `\psHertzDipole` command are much more modest; it allows only for the visualization of electric field lines, utilizing the following options (for which default values are indicated):

- `lambda=100`: selects the wavelength (in meters);
- `t=0`: date as a fraction of the period: 0 to 100;
- `h=1`: iteration step size for the method (RK-4) suggested by Raimund V. Girwidz;
- `FieldLines=6`: number of lines within the  $\lambda/2$  interval;
- `ScaleFactor=1`: scale factor;

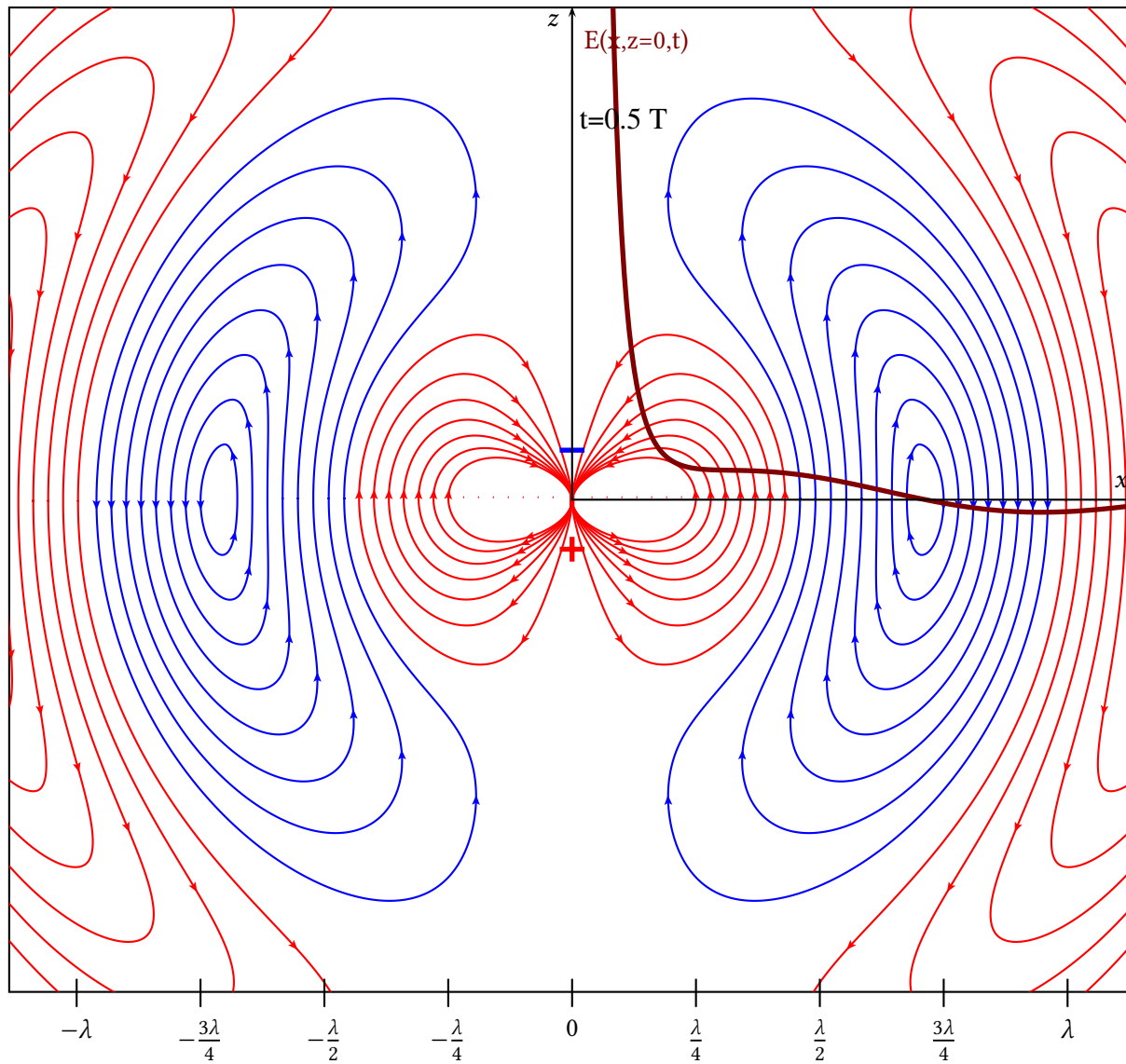
as well as the following Boolean options:

- `BiColorLines=false`: with the `BiColorLines` option, the color of the line bundles alternates; one color is defined by the PSTricks command `linecolor=...` and the other by `doublecolor=...`;
- `DrawArrows=true`: draws arrows by default;
- `DrawLines=true`: draws the lines by default;
- `Ez=true`: plots  $E(x, t)$  at the points  $x = 0$ ;
- `FillSpace=false`: colors the space between two consecutive lines using two colors—one defined by the PSTricks command `fillcolor=...` and the other by `hatchcolor=...`;
- `HSBFill=false` : : colors the space between the lines using color gradations from the HSB color space.

### 3 Examples

The drawing at the beginning illustrates the command using the default options; the tick marks have been added manually.

#### 3.1 The two-tone version



#### BiColorLines

```

1 \begin{pspicture}(-8,-8)(8,7)
2 \psclip{\psframe(-8,-7)(8,7)}
3 \psHertzDipole[t=50,lambda=200,h=1,BiColorLines,linecolor=red,doublecolor=blue,FieldLines=8]
4 \endpsclip%
5 \psline{<->}(0,7)(0,0)(8,0)
6 \uput[l](0,6.8){$z$}
7 \uput[u](7.8,0){$x$}
8 \uput[r](0,6.5){\textcolor{rougesombre}{E(x,z=0,t)}}
9 \psset{xunit=1pt}
10 \multido{\i=-200+50}{9}{
11 \psline(\i,-7.2)(\i,-6.8)}
12 \uput[d](-200,-7.2){$-\lambda$}

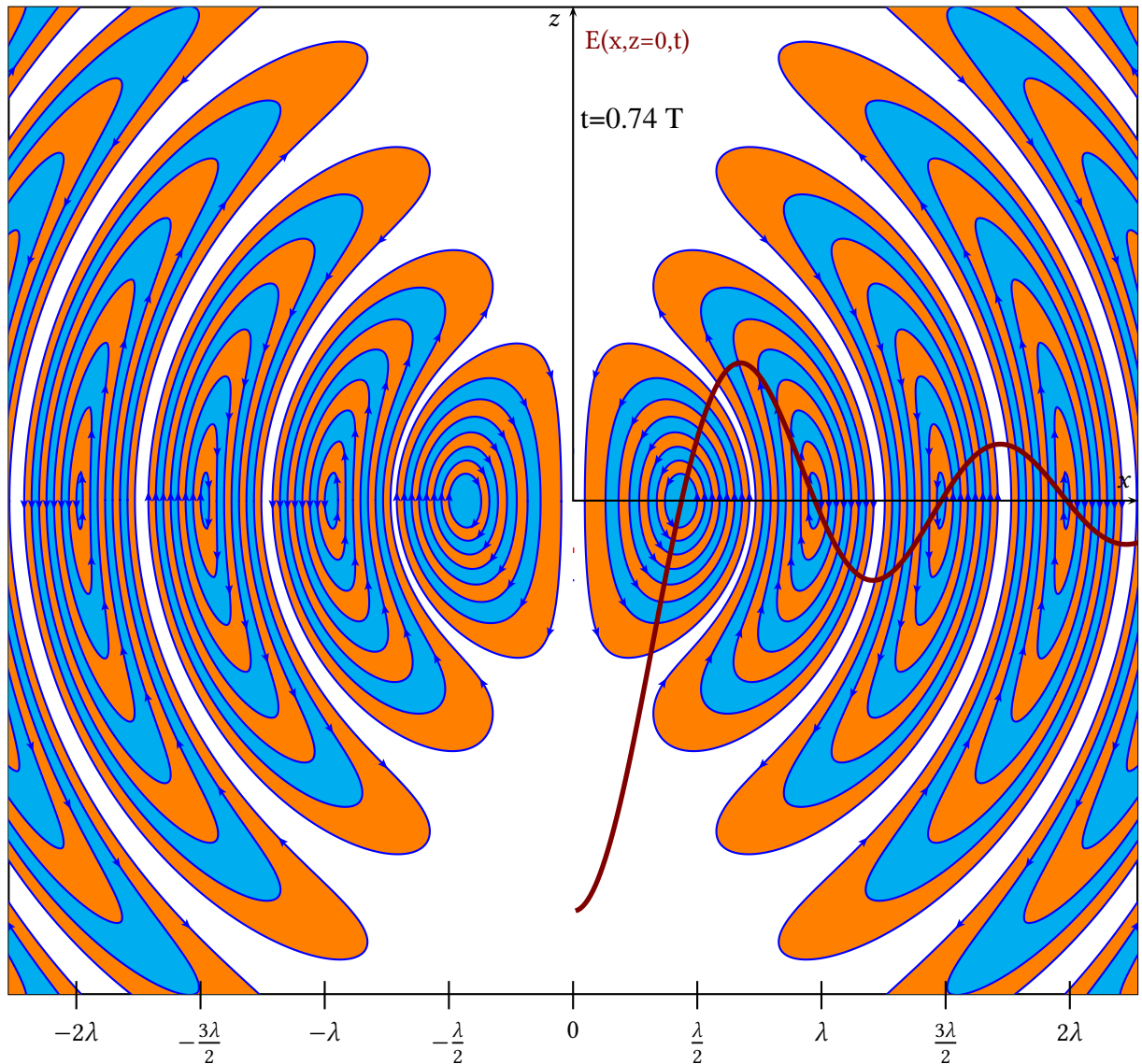
```

```

13 \uput[d](-150,-7.2){$\frac{3\lambda}{4}$}
14 \uput[d](-100,-7.2){$\frac{\lambda}{2}$}
15 \uput[d](-50,-7.2){$\frac{\lambda}{4}$}
16 \uput[d](200,-7.2){$\lambda$}
17 \uput[d](150,-7.2){$\frac{3\lambda}{4}$}
18 \uput[d](100,-7.2){$\frac{\lambda}{2}$}
19 \uput[d](50,-7.2){$\frac{\lambda}{4}$}
20 \uput[d](0,-7.2){$0$}
21 \end{pspicture}

```

### 3.2 Color the space between two lines



#### Colors space

```

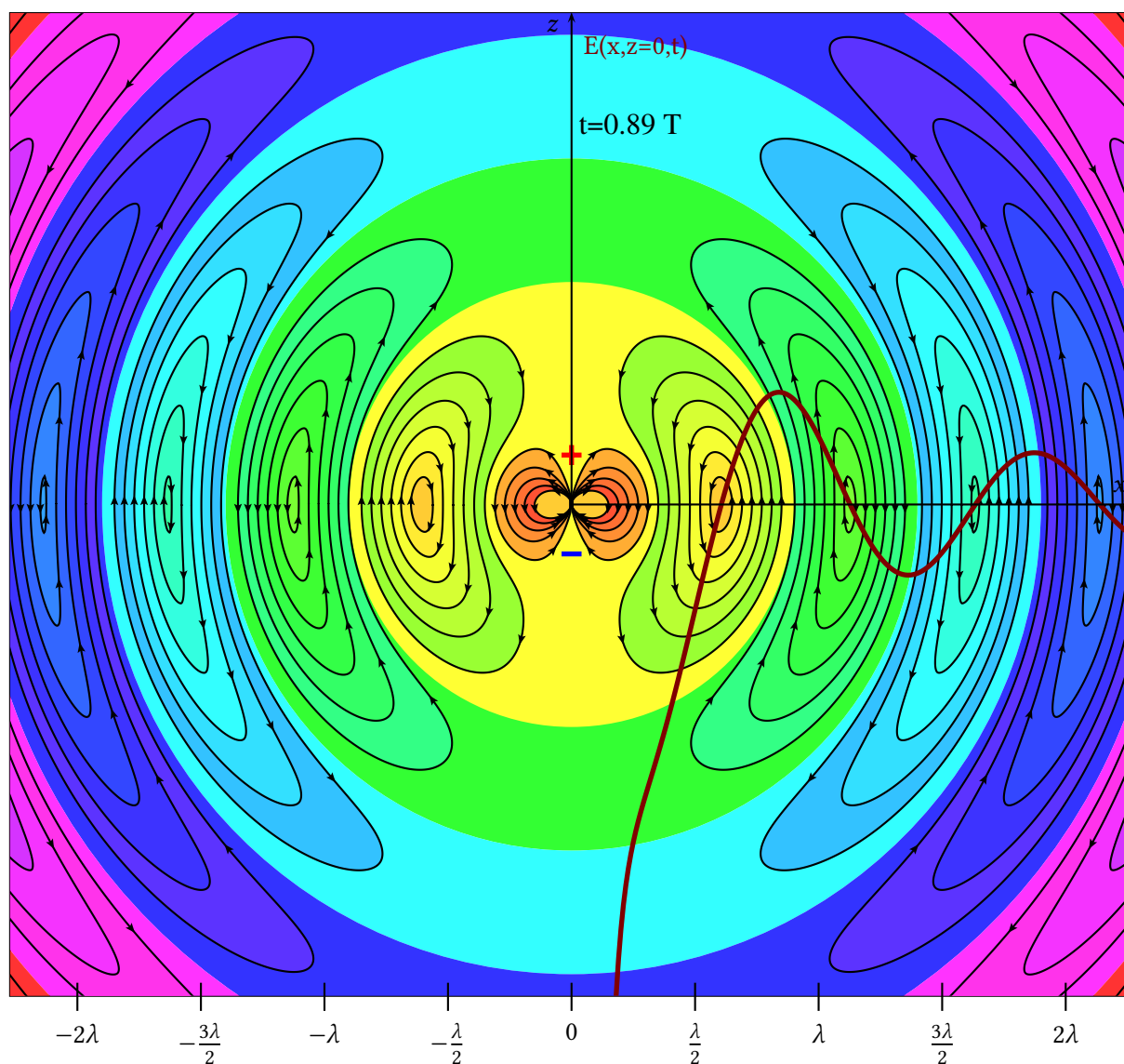
1 \begin{pspicture}(-8,-8)(8,7)
2 \psclip{\psframe(-8,-7)(8,7)}
3 \psHertzDipole[t=75,h=0.5,FillSpace,hatchcolor=orange,fillcolor=cyan,linecolor=blue,FieldLines=8]
4 \endpsclip%
5 \psline{<->}(0,7)(0,0)(8,0)
6 \uput[l](0,6.8){$z$}

```

```

7 \uput[u](7.8,0){$x$}
8 \uput[r](0,6.5){\textcolor{rougesombre}{E(x,z=0,t)}}
9 \psset{xunit=1pt}
10 \multido{\i=-200+50}{9}{
11 \psline(\i,-7.2)(\i,-6.8)}
12 \uput[d](-200,-7.2){$-2\lambda$}
13 \uput[d](-150,-7.2){$\frac{3}{2}\lambda$}
14 \uput[d](-100,-7.2){$-\lambda$}
15 \uput[d](-50,-7.2){$\frac{1}{2}\lambda$}
16 \uput[d](200,-7.2){$2\lambda$}
17 \uput[d](150,-7.2){$\frac{3}{2}\lambda$}
18 \uput[d](100,-7.2){$\lambda$}
19 \uput[d](50,-7.2){$\frac{1}{2}\lambda$}
20 \uput[d](0,-7.2){$0$}
21 \end{pspicture}

```



Fill space

```

1 \begin{pspicture*}(-8,-8)(8,7)
2 \psHertzDipole[t=90,h=0.5,FillSpace,HSBFill,FieldLines=6]

```

```

3 \psline{<->}(0,7)(0,0)(8,0)
4 \uput[l](0,6.8){$z$}
5 \uput[u](7.8,0){$x$}
6 \uput[r](0,6.5){\textcolor{rougesombre}{E(x,z=0,t)}}
7 \psset{xunit=1pt}
8 \multido{\i=-200+50}{9}{\psline(\i,-7.2)(\i,-6.8)}
9 \uput[d](-200,-7.2){$-2\lambda$}
10 \uput[d](-150,-7.2){$\frac{3\lambda}{2}$}
11 \uput[d](-100,-7.2){$-\lambda$}
12 \uput[d](-50,-7.2){$\frac{\lambda}{2}$}
13 \uput[d](200,-7.2){$2\lambda$}
14 \uput[d](150,-7.2){$\frac{3\lambda}{2}$}
15 \uput[d](100,-7.2){$\lambda$}
16 \uput[d](50,-7.2){$\frac{\lambda}{2}$}
17 \uput[d](0,-7.2){$0$}
18 \end{pspicture*}

```

## References

- [1] Raimund Girwidz. *Dipolstrahlung*. URL: [https://www.didaktik.physik.uni-muenchen.de/multimedia/programme\\_applets/e\\_lehre/dipolstrahlung/](https://www.didaktik.physik.uni-muenchen.de/multimedia/programme_applets/e_lehre/dipolstrahlung/) (visited on 05/28/2026).

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