

Documentation on the javaTM packet
Electro magnetic waves

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Abstract

This documentation describes the usage and functionality of two Java¹ applets with that different kinds of electro dynamical waves can be visualized. The applets are based on the “emwave1+2”² versions of Paul Falstad and are provided within the “OWL” project “e-Module zur Veranschaulichung der Theoretischen Physik“. The wave guide add on (TM) makes dielectrics, wave conductors and different resonators choosable. ³

¹Java and all Java-based trademarks are trademarks of Sun Microsystems, Inc. in the United States, other countries, or both.

²<http://www.falstad.com/emwave2>

³Translated to english by Stanislav Ax 01.04.2014

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Imprint

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Project: “Offensive Wissen durch Lernen“
“e-Module zur Veranschaulichung der Theoretischen Physik“
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1 Introduction

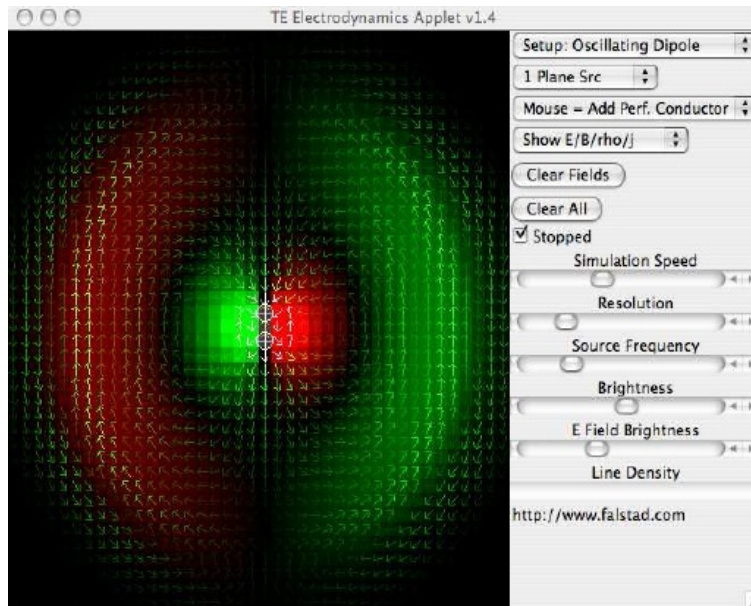


Figure 1: applet after the first call

What this applet may provide:

- Circular waves
- Planar waves
- Di and quadrupole radiation.
- Wave packets
- Mode oscillations
- Diffraction and interference effects

In the waveguide add on

- Refraction
- Reflection and transmission at the dielectric
- Waveguide

What this applet may not provide:

- Three dimensional waves
- Complex refractive indices

2 Usage

Right after the start of the applet (will be initialized in the browser if calling the related web page) a window will appear containing a preconfigured dipole field and the control menu for the control of the applet at the right edge of the window.

2.1 Field window (left)

An arbitrary size may be set by pulling at the windows edges. The resolution will stay the same but may be adjusted with the corresponding slider. In dependence of the chosen sight and mouse mode one can manipulate or generate sources, conductors, current flows, dielectrics and ferro and diamagnets. During the creation of own environments disruptive effects may occur and the calculation of the wave field may become very effortful for complex arrangements. Hence it is recommended to set the tick besides the “stopped”box during the creation of the wished environment.

2.2 Explanation of the controls

Pop up menu

- **First pop up menu Setup Field:** Here a multitude of configurations may be selected.

- **Second drop down menu Source:** Different sources may be selected with this. For example:

- Point sources
- Antennas
- Planar sources at the upper and/or lower window edge
- Transmitter loops

These may send continuous as well as pulsed (packets)

- **Third drop down menu Mouse Add:** In the original applet only a perfect conductor is provided that is drawn into the window pixel wise by clicking. In the add on the following materials may be included and varied.

- conductors (without any current)
- Conductors (current through flow)
- resonant media
- Dia and ferro magnets

Select “Show Material Type” in the “Show” menu to distinguish this types from each other.

• **Fourth drop down menu Show:** The following field parameters can be visualized:

- Normalized electric and magnetic field vectors (The field strength corresponds to the arrows color)
- Electric and magnetic field lines
- Electric and magnetic current
- Magnetize
- Poynting vector
- $\nabla \times \vec{E}$
- Force
- Energy density
- Charge
- Material types (the ones that have been placed into the field window)
- Vector potential

Buttons/Checkbox/Regulators

- **Button clear Fields:** deletes the field but not the materials and sources
- **Button clear All:** creates an empty field
- **Checkbox stopped:** stops the wave propagation
- **Regulator Simulation Speed:** should be adjusted if the computer is to slow
- **Regulator Resolution:** resolution of the vector field
- **Regulator Source Frequency:** frequency of the source
- **Regulator Brightness:** brightness of the field parameters
- **Regulator Line Density:** distance of the equipotential lines
- **Regulator Phase Difference:** only choseable if several sources are implemented

2.3 Stand alone Version

There are different possibilities to run the applet. One of them is to open it within the browser. Another is to run it with the Java Appletviewer. For this one has to type in the following command into the console.

```
appletviewer <address or path of the HTML file of the applet>
```

Two files are necessary to run the applet without internet connection. The first is the applet within a Jar file “emstatic.jar” and the HTML file for the call of the applet out of the Jar file. Both files have to be copied into a local directory and to be ran with the Java Appletviewer under specification of the directories path.