physics: a module for Asymptote

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1 Introduction

This manual describes a module called *physics* which adds some functionalities to Asymptote specially aimed at making the kind of illustrations that are found in Physics textbooks, as the ones shown in figure 1

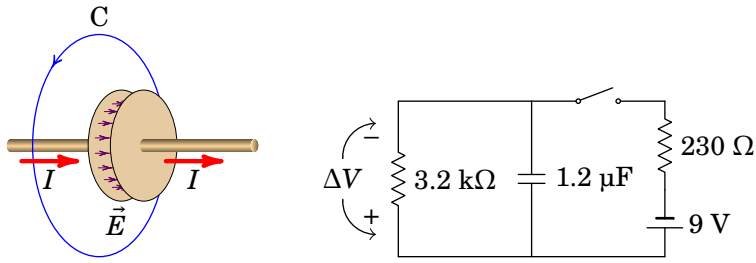

Figure 1: Some images made with Asymptote and the module physics.

2 Usage

To use this module you must have a copy of its source file physics.asy and import it, as in the following two examples, which draw the two images shown in figure 1.

Example 1

```
import physics;
picture c;
cylinder(c,3,50,0.6,hsv(36,0.4,1));
add(shift(-50,0)*rotate(-90)*c);
draw(shift(-10,0)*scale(30,50)*arc((0,0),1,0,360),blue,
     ArcArrow(HookHead,2,position=1.5));
label("C",(-10,50),N);
filldraw(scale(15,25)*unitcircle,hsv(36,0.3,0.9),black+0.3);
for(int a=90; a<280; a+=20)
  fieldline(scale(12,20)*dir(a)--scale(12,20)*dir(a)+(10,0),
            rgb(0.4,0,0.4)+0.4,0.6);
filldraw(shift(10,0)*scale(15,25)*unitcircle,hsv(36,0.3,0.9),
         black+0.3);
add(shift(10,0)*rotate(-90)*c);
label("$\vec{E}$",(5,-25),SW);
vector("$I$",(-45,-7),25,0,S,red);
vector("$I$",(20,-7),25,0,S,red);
```

Example 2

```
import physics;
pair[]
  z={(0,0),(60,0),(120,0),(0,70),(60,70),(120,70),(120,30)};
draw(z[0]--z[2]^^z[3]--z[4]);
resistor("3.2 k$\Omega$",z[0],z[3],E);
capacitor("1.2 µF",z[1],z[4],E);
resistor("230 $\Omega$",z[5],z[6],E);
emfn("9 V",z[6],z[2],E);
openswitch(z[4],z[5]);
vgaugep("$\Delta V$",(-10,10),(-10,60));
```

3 Functions reference

3.1 Drawing

```
void vector(picture pic=currentpicture, Label s="",
            explicit pair orig, real mag, real ang,
            align align=NoAlign, pen p=currentpen)
void vector(picture pic=currentpicture, Label s="",
            explicit pair orig, explicit pair dest,
            align align=NoAlign, pen p=currentpen)
```

Draws a vector using pen `p`, starting at point `orig` and ending at point `dest` or with magnitude `mag` and in the direction `ang`, starting from point `orig`. Label `s` will be typed aligned according to `align`. Unlike draw, the current pen will be used for type the label, rather than the vector pen `p`.

```
void vectorin(picture pic=currentpicture, Label s="",
              explicit pair orig, align align=NoAlign,
              pen p=currentpen)
```

Draws a vector going into the figure's plane, using pen `p`, at point `orig`. Label `s` will be typed aligned according to `align`, using the current pen rather than the vector pen `p`.

```
void vectorout(picture pic=currentpicture, Label s="",
               explicit pair orig, align align=NoAlign,
               pen p=currentpen)
```

Draws a vector coming out of the figure's plane, using pen `p`, at point `orig`. Label `s` will be typed aligned according to `align`, using the current pen rather than the vector pen `p`.

```
void fieldline(picture pic=currentpicture, Label L="", path g,
               align align=NoAlign, pen p=currentpen,
               real pos=0.5)

pen darkerpen (pen p=currentpen, real f)
```

3.2 3D objects projected into 2D

```
guide boxy(pair o=(0,0),real dx, real dz)
guide boxz(pair o=(0,0),real dx, real dy)
guide boxx(pair o=(0,0),real dy, real dz)

pair isometric(real x, real y, real z)
```

3.3 Shading

```
void centershade(picture pic=currentpicture, path p,
                 bool stroke=false, pen in, pen out,
                 pen drawpen=currentpen)

void sphere(picture pic=currentpicture, real r=1, pair c=(0,0),
            pen p=currentpen, pen q=darkerpen(p,0.25))

void cylinder(picture pic=currentpicture, real r=1, real h=2,
         real f=0.3, pair c=(0,0), pen p=currentpen,
         pen q=darkerpen(p,0.4))

void hollow_cylinder(picture pic=currentpicture, real r=1,
                     real h=2, real f=0.3, pair c=(0,0),
                     pen p=currentpen, pen q=darkerpen(p,0.4))

void ring(picture pic=currentpicture, real r1=1, real r2=0.5,
          real h=2,

real f=0.3, pair c=(0,0), pen p=currentpen)

void torus(picture pic=currentpicture, real r1=1, real r2=0.5,
           pair c=(0,0), pen p=currentpen)
void torus(picture pic=currentpicture, real r1, real r2,
           pair c=(0,0), pen p=currentpen)
```

```
void torus_arc(picture pic=currentpicture, real r1, real r2,
          real ang1, real ang2, pair c=(0,0), pen p=currentpen)

void toroidal_cylinder(picture pic=currentpicture, real r1,
                       real r2, real ang1, real ang2,
                       pair c=(0,0), pen p=currentpen,
                       bool cap=true)
```

3.4 Circuit diagrams

```
void resistor(picture pic=currentpicture, Label s="",
              explicit pair orig, real mag, real ang, pair d=N,
              pen p=currentpen)
void resistor(picture pic=currentpicture, Label s="",
              explicit pair orig, explicit pair dest, pair d=N,
              pen p=currentpen)

void inductor(picture pic=currentpicture, Label s="",
              explicit pair orig, real mag, real ang, pair d=N,
              pen p=currentpen)

void inductor(picture pic=currentpicture, Label s="",
              explicit pair orig, explicit pair dest, pair d=N,
              pen p=currentpen)

void emfp(picture pic=currentpicture, Label s="",
          explicit pair orig, real mag, real ang, pair d=N,
          pen p=currentpen)

void emfp(picture pic=currentpicture, Label s="",
          explicit pair orig, explicit pair dest, pair d=N,
          pen p=currentpen)

void emfn(picture pic=currentpicture, Label s="",
          explicit pair orig, real mag, real ang, pair d=N,
          pen p=currentpen)

void emfn(picture pic=currentpicture, Label s="",
          explicit pair orig, explicit pair dest, pair d=N,
          pen p=currentpen)

void capacitor(picture pic=currentpicture, Label s="",
               explicit pair orig, real mag, real ang, pair d=N,
               pen p=currentpen)
```

```
void capacitor(picture pic=currentpicture, Label s="",
               explicit pair orig, explicit pair dest, pair d=N,
               pen p=currentpen)

void ground(picture pic=currentpicture, explicit pair orig,
            real mag, real ang, pen p=currentpen)

void ground(picture pic=currentpicture, explicit pair orig,
            explicit pair dest, pen p=currentpen)

void openswitch(picture pic=currentpicture, Label s="",
                explicit pair orig, real mag, real ang,
                pair d=N, pen p=currentpen)

void openswitch(picture pic=currentpicture, Label s="",
                explicit pair orig, explicit pair dest,
                pair d=N, pen p=currentpen)

void closedswitch(picture pic=currentpicture, Label s="",
                  explicit pair orig, real mag, real ang,
                  pair d=N, pen p=currentpen)

void closedswitch(picture pic=currentpicture, Label s="",
                  explicit pair orig, explicit pair dest,
                  pair d=N, pen p=currentpen)

void ammeter(picture pic=currentpicture, explicit pair orig,
             real mag, real ang, pen p=currentpen)

void ammeter(picture pic=currentpicture, explicit pair orig,
             explicit pair dest, pen p=currentpen)

void voltmeter(picture pic=currentpicture, explicit pair orig,
               real mag, real ang, pen p=currentpen)

void voltmeter(picture pic=currentpicture, explicit pair orig,
               explicit pair dest, pen p=currentpen)

void meter(picture pic=currentpicture, Label s,
           explicit pair orig, real mag, real ang,
           pen p=currentpen)
```

```
void meter(picture pic=currentpicture, Label s,
           explicit pair orig, explicit pair dest,
           pen p=currentpen)

void vgaugep(picture pic=currentpicture, Label s="$V$",
             explicit pair orig, real mag, real ang,
             pen p=currentpen)

void vgaugep(picture pic=currentpicture, Label s="$V$",
             explicit pair orig, explicit pair dest,
             pen p=currentpen)

void vgaugen(picture pic=currentpicture, Label s="$V$",
             explicit pair orig, real mag, real ang,
             pen p=currentpen)

void vgaugen(picture pic=currentpicture, Label s="$V$",
             explicit pair orig, explicit pair dest,
             pen p=currentpen)

void vsourcep(picture pic=currentpicture, Label s="$V$",
              explicit pair orig, real mag, real ang,
              pen p=currentpen)

void vsourcep(picture pic=currentpicture, Label s="$V$",
              explicit pair orig, explicit pair dest,
              pen p=currentpen)

void vsourcen(picture pic=currentpicture, Label s="$V$",
              explicit pair orig, real mag, real ang,
              pen p=currentpen)

void vsourcen(picture pic=currentpicture, Label s="$V$",
              explicit pair orig, explicit pair dest,
              pen p=currentpen)

void isource(picture pic=currentpicture, Label s="",
             explicit pair orig, real mag, real ang, pair d=N,
             pen p=currentpen)

void isource(picture pic=currentpicture, Label s="",
             explicit pair orig, explicit pair dest, pair d=N,
             pen p=currentpen)
```

```
void acsource(picture pic=currentpicture, Label s="",
              explicit pair orig, real mag, real ang, pair d=N,
              pen p=currentpen)

void acsource(picture pic=currentpicture, Label s="",
              explicit pair orig, explicit pair dest, pair d=N,
              pen p=currentpen)

void acgauge(picture pic=currentpicture, Label s="$V$",
             explicit pair orig, real mag, real ang,
             pen p=currentpen)

void acgauge(picture pic=currentpicture, Label s="$V$",
             explicit pair orig, explicit pair dest,
             pen p=currentpen)

void impedance(picture pic=currentpicture, Label s="",
               explicit pair orig, real mag, real ang, pair d=N,
               pen p=currentpen)

void impedance(picture pic=currentpicture, Label s="",
               explicit pair orig, explicit pair dest, pair d=N,
               pen p=currentpen)

void diode(picture pic=currentpicture, Label s="",
           explicit pair orig, real mag, real ang, pair d=N,
           pen p=currentpen)

void diode(picture pic=currentpicture, Label s="",
           explicit pair orig, explicit pair dest, pair d=N,
           pen p=currentpen)

void LED(picture pic=currentpicture, Label s="",
         explicit pair orig, real mag, real ang, pair d=N,
         pen p=currentpen)

void LED(picture pic=currentpicture, Label s="",
         explicit pair orig, explicit pair dest, pair d=N,
         pen p=currentpen)

void cccc(picture pic=currentpicture, Label s="", path[] g,
          explicit pair orig, real mag, real ang, pair d,
          pen p=currentpen)
```