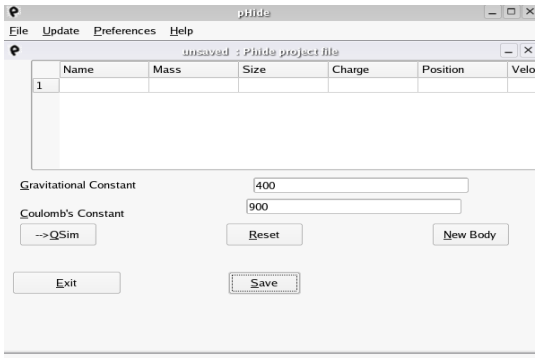
# The Physicist

## Documentation



### Getting Started

The Physicist is a physics simulator , by virtue of which it is possible to visualize upto a high degree of accuracy , the actual behaviour of any number of bodies under their mutual gravitational forces. It is also possible to simulate the bodies with a finite initial velocity and/or acceleration . What's more .. the bodies can also posses electrostatic charges!


A certain version of Phide looks like this..

So much so about Phide! But what is Phide anyways??

Well, Phide is something you can use to greatly simplify the usage of The physicist. This is mainly because Phide is a GUI , and supposedly incorporates most of the power of The Physicist into itself.. More about Phide later.. Now let us see how to work with The Physicist as a professional would ..

To start The Physicist ,

under windows , open the folder where The Physicist is installed
double click the folder called
bin
and double click
Goeppert.exe

In linux , change the directory to the place where The Physicist is located and type
cd bin
and then
./Goeppert

Well , that's not all.. now what you need to know mainly are the COMMANDS.. without them , this would just be as innocent as any other simulator...
So lets take a look at the COMMANDS!!

2. The Command Set

The Physicist consists of a huge set of commands, which empower you to practically have the bodies behave the way you expect it to...
We hope to cover most of the commands here, though not all...

## Mathematics Set

Using these commands , it is possible to have The Physicist act as a scientific calculator..
-just kidding...!! Certainly not as a scientific calculator , but atleast close...

1. Operators :
   - + : addition
   - - : subtraction ( this is used for subtraction.. so use (-value) for negative values )
   - * : multiplication
   - / : division
   - ^ : exponentiation

   As if you didnt know that!
   Usage examples : 2 + 3 <enter> [infix standard notation]
   5
   + 5 2 <enter> [prefix notation]
   7
   the postfix notation also works.

2. Functions

   Trigonometric :
   sin(x)
   cos (x) x is in radians
   tan(x)
   example : sin(20) <enter>
   .9129

## Mechanics Set

These commands can be used to create bodies and assign them various attributes like mass , velocity etc..

1. **m_body** command
   This command creates a body with **zero** initial parameters..
   syntax : **m_body** *<body name>*
   *description : well,* **m_body** *i*s the command , you type it as it is,
   *<body name>* is any string, whose length is lesser than 128.
   example : **m_body** *trial_body*
   What this does : well, you just created a body called *trial_body* whose initial position , velocity and acceleration are zero.

2. **m_setmass** command
   This lets you assign a mass to an already created body. The mass is in scaled units.
   Syntax : **m_setmass** *<body name> <mass>*
   description: **m_setmass** is the command
   *<body name>* is a string , the name of a body created previously using the m_body command
   *<mass>* is the mass of the body you wish to assign. It is a real constant. Negatives allowed.
   Example : **m_setmass** *trial_body* 300
   What this does : the mass of body *trial_body* is set to 300 scaled units.

3. **m_setsize** command
   This is used to set the radius of the object ( spherical by default) you create. It is essential to set this parameter, otherwise it will cause undesired results.
   Syntax : **m_setsize** *<body name> <size>*
   description : **m_setsize** is the command
   *<body name>* is a string , which corresponds to a body created using **m_body**
   *<size>* is a real constant , preferrably < 1 . optimum size is .5
   Example : **m_setsize** *trial_body* .4
   What it does : it sets the radius of *trial_body* equal to .4 units.
4. **m_setcharge** command
   This is used to set the electrostatic charge of the body . The charge is in scaled units .
   Syntax : **m_setcharge** *<body name> <charge>*
   description : **m_setcharge** is the command
   *<body name>* is a string , which corresponds to a body created using **m_body**
   *<charge>* is a real constant . set it to 0 for uncharged bodies
   Example : **m_setcharge** *trial_body* -50
   What it does : it sets the charge of *trial_body* equal to -50 units.
5. **m_setpos** command
   This is used to set the position of the body relative to origin , located at the center of the screen . Roughly, the edge of screen corresponds to 5.
   Syntax : **m_setpos** *<body name> <pos_x pos_y pos_z>*
   description : **m_setpos** is the command
   *<body name>* is a string , which corresponds to a body created using **m_body**
   *<pos_x pos_y pos_z>* is a vector , where *pos_x* denotes the displacement of the body in the x direction with centre of screen as reference. *pos_y , pos_z* denote the respective displacements in y and z direction.
   Example : **m_setpos** *trial_body* .5 0 0
   What it does : it sets the position of *trial_body* .5 units from origin in x direction and 0 in y and z directions.
6. **m_setvel** command
   This is used to set the velocity of the body relative to rest.
   Syntax : **m_setvel** *<body name> <vel_x vel_y vel_z>*
   description : **m_setvel** is the command
   *<body name>* is a string , which corresponds to a body created using **m_body**
   *<vel_x vel_y vel_z>* is a vector , where vel*_x* denotes the velocity of the body in the x direction . vel*_y , vel_z* denote the respective velocities in y and z direction.
   Example : **m_setvel** *trial_body* 10 10 0
   What it does : it sets the x component of velocity of *trial_body* equal to 10 units , y component of velocity equal to 10 and 0 z component of velocity.
7. **m_setacc** command
   This is used to set the initial acceleration of the body relative to rest.
   Syntax : **m_setacc** *<body name> <acc_x acc_y acc_z>*
   description : **m_setacc** is the command
   *<body name>* is a string , which corresponds to a body created using **m_body**
   *<acc_x acc_y acc_z>* is a vector , where acc*_x* denotes the acceleration of the body in the x direction . acc*_y , acc_z* denote the respective accelerations in y and z direction.
   Example : **m_setacc** *trial_body* 1 0 (-1)
   What it does : it sets the x component of acceleration of *trial_body* equal to 1 unit , y component of velocity equal to 0 and z component of velocity equal to -1. ( note the bracketing of -1 .. this is how negative values are given in The physicist)

Now that you are all done , you'd like to see your body isn't it ? You can do it by typing the following :

8. **m_show** command
   This command shows the attributes of a previously created body ( in command prompt).
   Syntax : **m_show** *<body name>*
   description : **m_show** is the command
   *<body name>* is a string , which corresponds to a body created using **m_body**
   Example : **m_show** *trial_body*
   What it does : It outputs the parameters of the body in an easy to follow format.

9. **Render** command
   This command is used to finally simulate the bodies and view the output.
   Syntax : **render**
   Example: **render**
   What it does : Pretty clear , i think..
10. List Command
    Oh! You wanted to see a list of all the bodies you've created? It is exactly what this is for..
    Syntax : list
    Example: list
    What it does : lists out all the bodies created prior to the issuing of this command.

So you've been promised a gravitational simulation! But how does one get a simulation without gravitational force ? You can set the global parameters , which hold as universal truths for all bodies . These are constants such as gravitational constant and Coulomb's constant. Just like everything else in this simulator is scaled , these are too. It is best to set a value of 400 or so for G and 200 for K if required. If these are not set , default values are assumed. But how in the world does one set these values?

11. **m_setg** command
    This is used to set the value of universal gravitational constant.
    Syntax : **m_setg** *<value>*
    Example : **m_setg** 200
    What it does : it sets the value of G = 200 for use in computation of gravitational acceleration as
    $$F = \frac{G \times M}{r^2}$$
12. m_setk command
    This is used to set the value of Coulomb's constant.
    Syntax : **m_setk** *<value>*
    Example : **m_setk 100.21**
    What it does : it sets the value of K = 100.21 for use in computation of electrostatic acceleration as
    $$F = \frac{K \times Q}{R^2}$$

Uh!! enough of all this.. how do I quit this program ?

13. **exit** command
    Under the unfavourable event of you having to quit the program without saving any data , type **exit**.

A sample "hello world "program :
Here's a sample program code , which will create a body , which moves in a parabolic path.. The output is also given..

```
<==>m_body a

<==>m_setmass a 50

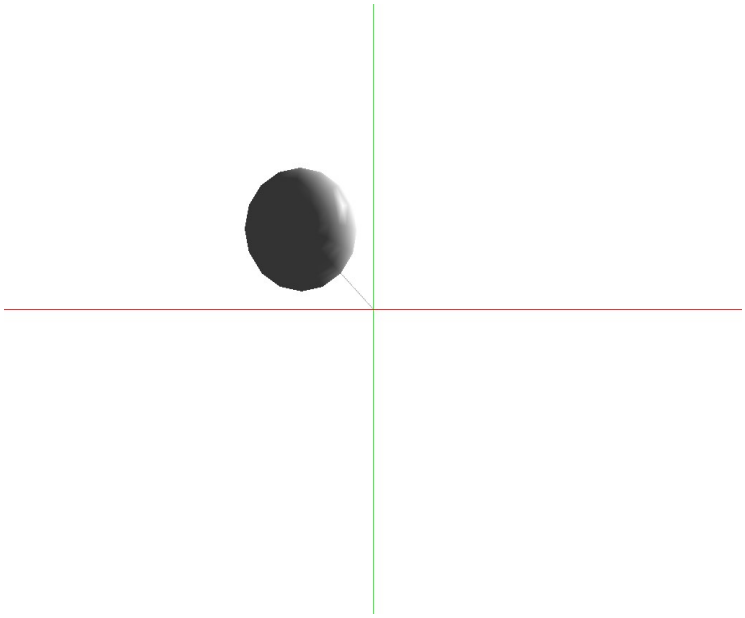
<==>m_setsize a .5

<==>m_setvel a (-10) 10 0

<==>m_setg 50
```

of course , you must type render to get the output :

```
<==>render
```



This is the output.. on my AMD K6-2 350 Mhz, it runs quite well..

Well, this is one way of running a simulation..
but the experienced user always has more..

1. The *editor-compiler* way
   As most of us are familiar with writing code in a separate text editor and the compiling it , The Physicist can also do the same.. Follow these steps in order to accomplish it :
   1. Fire up your favorite text editor .. i'd recommend gvim or emacs .. notepad isn't any good..
   2. Type in the code for the simulation
   3. Save it with a .tphy or .phy extension in the bin folder of The Physicist.. for example , let us call it sim.tphy
   4. close the editor

   5.1 In linux , go to the bin directory of The physicist and type :
   ./Goeppert sim.tphy

   5.2 In Windows , drag and drop the .tphy file into goeppert.exe file.
   Note : Don't forget to add a render command to the end of the .tphy file or you wouldn't get any output!

2. The *Phide* way
   Phide is the GUI IDE to The Physicist. It is fully integrated with the simulator and provides equal functionality as The Physicist itself.
   To Use Phide , follow these instructions..
   In Windows ,
   1. change the directory to the bin folder of The Physicist
   2. double click Phide.exe or Qsimulate.exe depending on your version of Phide.

   In Linux ,
   1. cd to bin folder of The Physicist
   2. type ./Qsimulate or ./phide depending on your version of Phide.

   Phide will not be documented more here as the help submenu of Phide itself does quite a good job.

   System Requirements

Hardware

The Physicist requires very minimalistic hardware for simulations :

| Minimum requirements | Recommended requirements |
|---|---|
| Colour monitor | 17"Colour monitor |
| 350 Mhz processor | 2.2 Ghz processor |
| 5 Mb free disk space | 8 Mb free disk space |
| 64 Mb RAM | 128 Mb RAM |

Software

In Linux

1. X windows
2. QT
3. Open GL
4. Kernel 2.4 or higher
5. Automake and Autoconf in case you want to compile the source of The Physicist

In Windows

1. The QT dll , which we will provide
2. Glut32.dll , provided by us
3. Windows XP or higher
4. Windows Installer

FAQ

1. I Need more help.. what do I do ?
   Visit oper17.sf.net and/or mail oper17.inc@gmail.com for more help
2. I need help on how to Install the software
   Read INSTALL file in the installation kit
3. I want to save a simulation
   Saving graphics is futile.. Instead save your tphy file. It always produces the same results
4. Is there The Physicist for Linux as well ?
   Obviously
5. How do I thank The Programmers of this software?
   Send a thanking email to oper17.inc@gmail.com and/or donate to our paypal account at oper17.sf.net
6. Who are the programmers of this software?
   The Physicist was made by a group of college students , called Oper17. It is comprised of the following members :
   1. R G Shivakeshvan
   2. Adithya Rajan
   3. Ravi Shankar K
   4. Vijay Ramnath
7. I want to contribute to the program by becoming a member of the team..
   As always , mail oper17.inc@gmail.com
8. Will there be any more releases of Phide?
   Expect more!
9. Is there any kind of licensing involved ?
   Ofcourse! Both The Physicist and Phide are licensed under GPL.

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Version 2, June 1991



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```
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```

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```
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  <signature of Ty Coon>, 1 April 1989
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