

# Python for Physicist

## Lecture Note - 1

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# Why Python?

- ▶ Easy to Learn
- ▶ Simple to Use
- ▶ Enormously Powerful
- ▶ Facilities and Features for Performing Task

# Getting Started

Linux (Ubuntu) distribution as Operating System.

- ▶ The first program in Python in Terminal

```
>>> print 'Hello World!'
```

- ▶ The first program in file 'hello.py'

```
print 'Hello World!'
```

- ▶ To run script in a file through Terminal:

```
$ python hello.py
```

# Variables and Assignments

- ▶ Sample Example:

```
x = 1  
print x
```

- ▶ Type of variables:

- ▶ **Integer:** Both the positive or negative integer. Not fraction.
- ▶ **Float:** Real or floating-point number.
- ▶ **Complex:** Can take a complex number as  $3.0 + 4.0j$
- ▶ **String:** The string can be set as `x = 'Test string'`

- ▶ Example of Interactive Programming:

```
x = input('Enter x: ')  
print 'The value of x is ', x
```

# Operators

- ▶ Arithmetic Operator:

- ▶ Addition:  $a + b$
- ▶ Subtraction:  $a - b$
- ▶ Multiplication:  $a * b$
- ▶ Division:  $a / b$
- ▶ Others:
  - ▶  $a ** b$ :  $a$  to the power  $b$
  - ▶  $a // b$ : integer part of  $a$  divided by  $b$
  - ▶  $a \% b$ : the remainder after  $a$  is divided by  $b$

- ▶ Example:

- ▶  $x + 2*y - z**3$  is equivalent to  $x + 2y - z^3$

- ▶ Exercise:

- ▶ What will be the Python equivalent of  $x = (a + b)/c^5$

# Simple Physics Problem

- ▶ Problem:

- ▶ If a ball falls from a tower (Height =  $H$ ) freely, what would the height ( $h$ ) after a time  $t$ .

- ▶ Analysis:

- ▶ The physics behind the problem is associate the free falling body is  $s = \frac{1}{2}gt^2$ . Thus, we need to give input for the height of the tower,  $H$  and the time passed by the falling ball,  $t$  to get the output result of heigh,  $h = H - s$ .

- ▶ The Python code:

```
H = float(input('Input the height of the tower: '))
t = float(input('Input the duration of travel: '))
s = 0.5 * 9.81 * t**2
print 'The height is ', H - s, ' after time ', t
```

# Simple Physics Exercise

- ▶ Exercise 1:

- ▶ For a satellite, orbiting around the earth with a time period,  $T$ , we know that

- ▶  $h = \left( \frac{GMT^2}{4\pi^2} \right)^{\frac{1}{3}} - R$

- ▶ Where  $G = 6.67 \times 10^{-11} m^3 kg^{-1} s^{-2}$ ,  $M = 5.97 \times 10^{24} kg$  and  $R = 6371 km$
- ▶ Write a program to calculate the altitude of a satellite for the input time period.