

# PYTHON FOR ASTROPHYSICS

## Lecture 2

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# Lecture 2 goals:

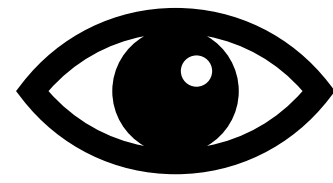
1. High-level vs low-level programming languages
2. Why is Python optimal for astrophysics?
3. Master Google Colab for Python.

## What do you need for the practicals?

- A PC/laptop with any OS.
- Internet access.
- A Google/gmail account.
- A GitHub account (desirable, not strictly needed).

# High-level vs. Low-level languages

Human  
High-level

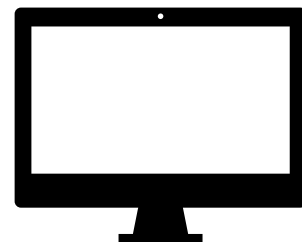


Python, Julia, IDL/GDL,  
Mathematica, Matlab

C++, java

C89/90, Fortran77/90

Computer  
Low-level



Binary (01001000)

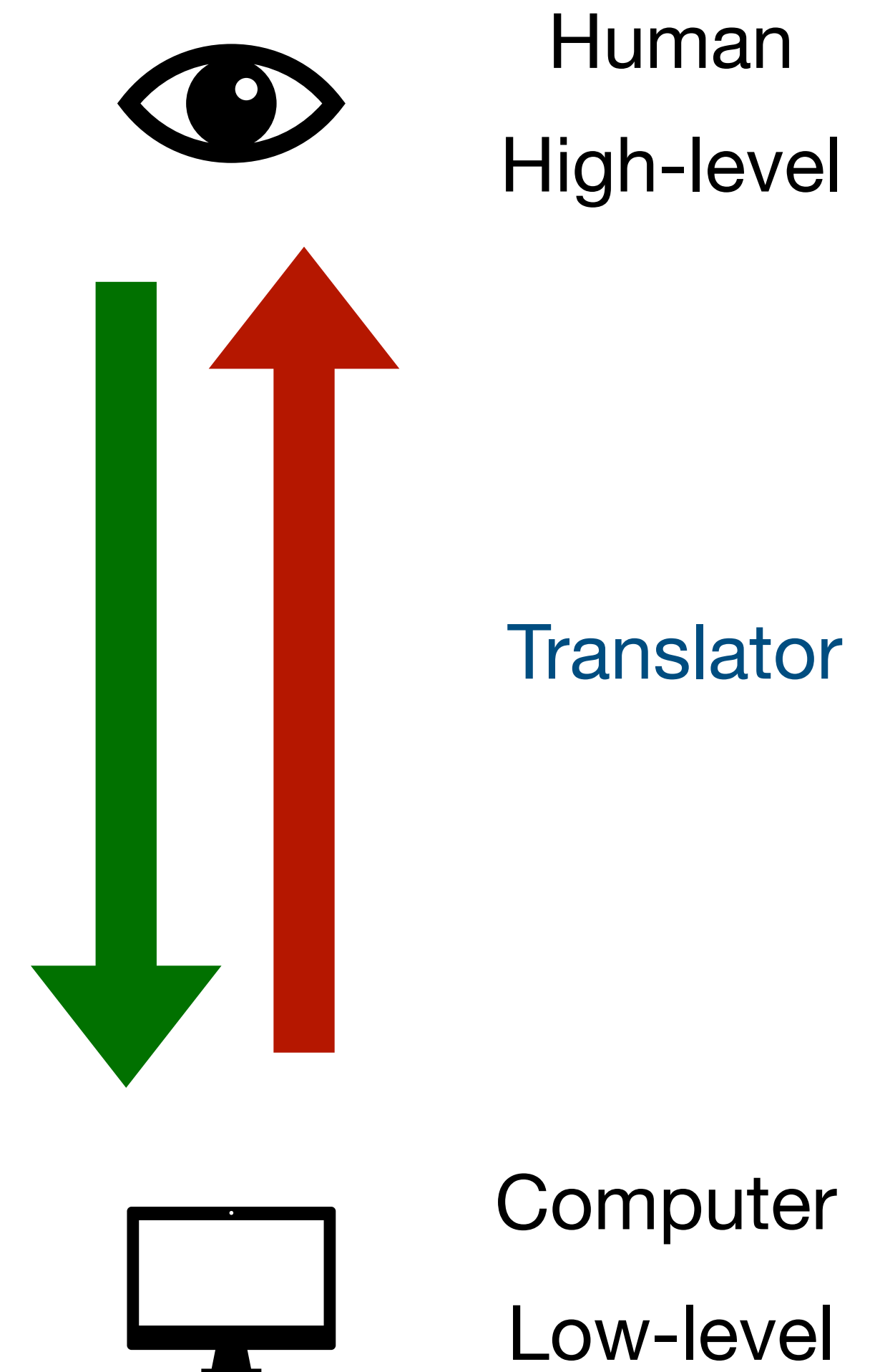
# High-level vs. Low-level languages

Programs written in a high-level language **have to be processed** before they can run.

This **extra processing takes some time**, which is a small disadvantage of high-level languages.

Low-level programs can run on only one kind of computer and **have to be rewritten to run on another**.

Roughly speaking, computers **can only execute programs written in low-level languages**.



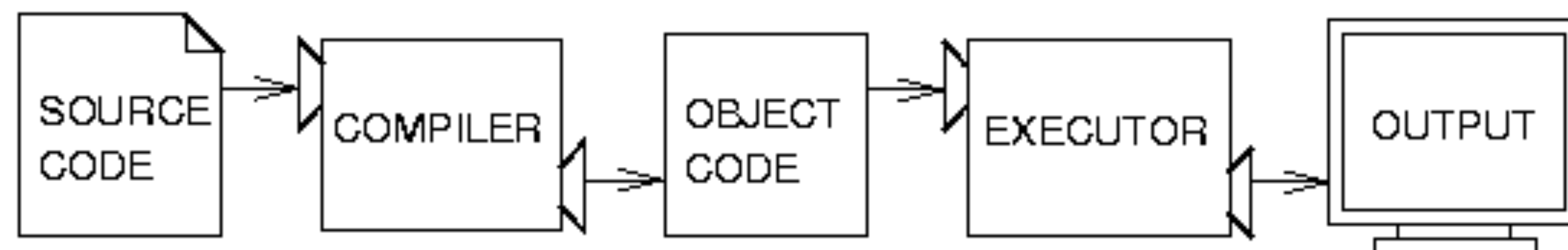
# Interpreter vs. Compiler

Two kinds of programs process high-level languages into low-level languages: **interpreters** and **compilers**.

An **interpreter** reads a high-level program and executes it. It processes the program alternately reading lines and performing computations.



A **compiler** reads the program and translates it completely before the program starts running. The program is the **source code**, and the translated program is called the **object code** or the **executable**. Once compiled, you can execute it repeatedly without further translation.



# Why python?

Python is considered an interpreted language because Python programs are executed by an interpreter.

The advantages of high-level languages are enormous:

- It is much easier to program in a high-level language.
- Programs written in a high-level language take less time to write.
- They are shorter and easier to read, and they are more likely to be correct.
- They are portable, meaning that they can run on different kinds of computers with few or no modifications.

Low-level languages are used only for a few specialised applications.

# Package Managers

**pip** (python-specific package installer)

**conda** (language-agnostic package and environment manager)

**Anaconda** (Full version)

**Miniconda** (Reduced version)

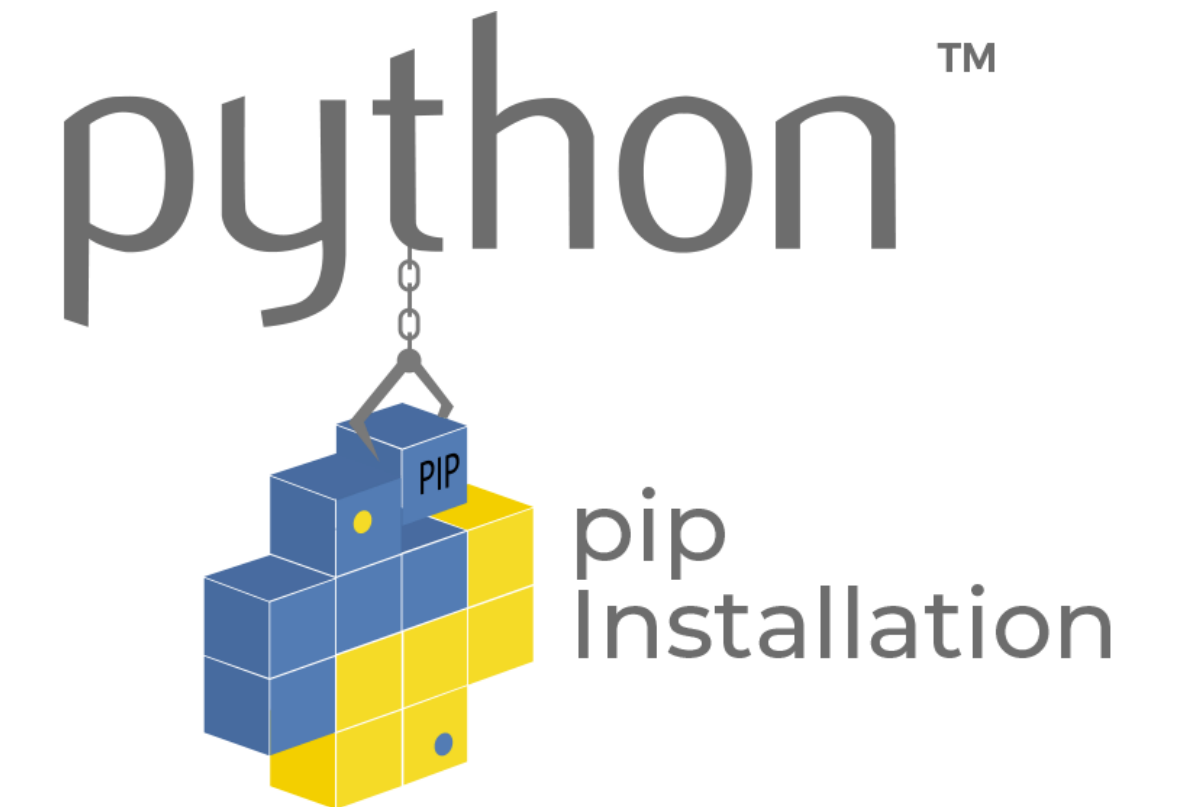
**source** installation

**Python Executable:**

/usr/bin/python3

**Standard Library & Third-Party Packages** (site-packages)

/usr/lib/python3.x



# Programming / IDE Tools

An IDE (Integrated Development Environment) is an application that provides comprehensive tools for software development.

An IDE consists of a source code editor, build automation tools (like compilers and interpreters), and a debugger.

Popular IDE choices are:

- Visual Studio Code (VS Code)
- Sublime Text
- Spyder
- Android Studio
- Xcode (Apple)
- **Google Colab** (cloud-based Jupyter notebook environment with IDE-like features)



**Tutorial**



# Tutorial Time

1. Please log into your gmail accounts:



2. Open this lecture on GitHub:

[https://github.com/Astronomia-Ecuador/  
ISYA2025/blob/main/Python for Astrophysics/  
01\\_programming\\_essentials.ipynb](https://github.com/Astronomia-Ecuador/ISYA2025/blob/main/Python%20for%20Astrophysics/01_programming_essentials.ipynb)



3. Click on the “**Open in Colab**” icon and you are ready to code!

