



ESCUELA
POLÍTÉCNICA
NACIONAL

cedia
CORPORACIÓN ECUATORIANA
PARA EL DESARROLLO DE LA
INVESTIGACIÓN Y LA ACADEMIA

UNIVERSIDAD
YACHAY
TECH

BOOTCAMP DE PROCESAMIENTO DE IMÁGENES CON INTELIGENCIA ARTIFICIAL

Astronomía educativa, cultural y técnica

Wladimir E. Banda-Barragán

2025

Astronomía educativa, cultural y técnica

- La Unión Astronómica Internacional (IAU): su rol y la OYA.
- Iniciativas culturales y divulgativas en ciencias
- Astronomía cultural y astro turismo
- **Astronomía y educación (e.g. applets digitales y software)**
- Simulaciones educativas de sistemas físicos en Fortran.
- La red cósmica y la estructura a gran escala del Universo.
- Inteligencia artificial y astronomía.
- Divulgación en astronomía: esfuerzos de la comunidad ecuatoriana.
- Diversidad en ciencias / STEM
- Observaciones astronómicas



Applets Digitales de Astronomía

Material didáctico en Python para la
enseñanza de física y astronomía

Wladimir E. Banda-Barragán
wbanda@yachaytech.edu.ec

Universidad Yachay Tech

¿De qué trata esta charla?

Esfuerzos para desarrollar material de soporte
a la enseñanza de física y astronomía.

¿Qué motiva estos esfuerzos?

La computación juega un papel fundamental y
puede ayudar a entender conceptos abstractos.

¿Para quienes queremos diseñar el material?

Docentes de pregrado y secundaria.

Estudiantes de pregrado, estudiantes de secundaria.

¿Por qué es esto importante?

Tenemos las herramientas a nuestra disposición. Pocos esfuerzos en español.

¿Cómo lograrlo?

1. Usando el método científico.
2. Creando una plataforma digital.
3. Con proyectos comunitarios.

1. Usando el método científico

Observamos un fenómeno



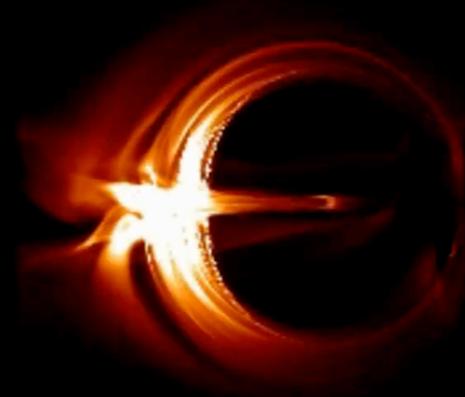
Galaxias mariposa, Gemini Observatory

Modelamos teóricamente



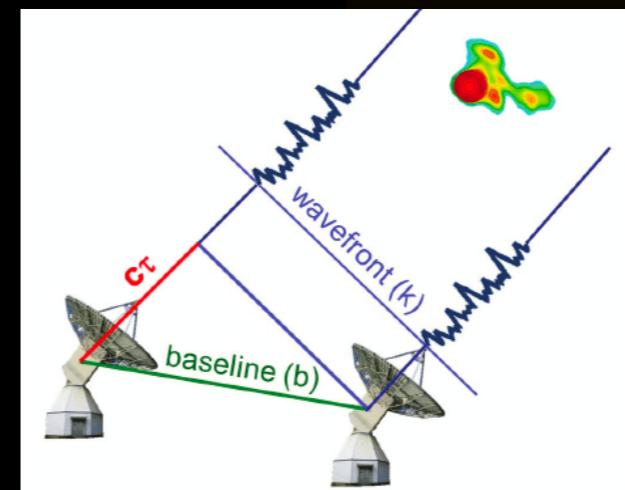
Space Telescope Science Institute

Predecimos con modelos teóricos



EHT Theory Working Group

Buscamos el fenómeno



Agujero Negro en el centro de M87

Desarrollar programas en Python para entender fenómenos físicos.

2. Creando una plataforma digital

The screenshot shows a GitHub profile for the user `wbandabarragan`. The profile picture is a 3D visualization of a complex network or simulation results. The user's name is **Wladimir Eduardo Banda Barragán**, and their GitHub handle is `wbandabarragan · he/him`. They are listed as an **Astrofísico**. The profile includes a button to **Edit profile**.

The top navigation bar shows **Overview** (selected), **Repositories** (25), **Projects**, **Packages**, and **Stars**. A search bar at the top right contains the placeholder `Type / to search`.

The main content area is divided into sections:

- Pinned:** A grid of five repository cards:
 - `computational-physics-1` (Public): Lecture notes and programming exercises for Computational Physics 1.
 - `quantum-mechanics-1` (Public): Lecture notes and exercises for Quantum Mechanics 1.
 - `cloudy_cooling_tools`: Forked from `brittonsmith/cloudy_cooling_tools`. Create an N-dimensional grid of models with the Cloudy photoionization code.
 - `computational-physics` (Public): JavaScript code for computational physics.
 - `computational-physics-1-arxiv` (Public): Archived versions of Computational Physics 1 courses.
 - `ISYA_2025` (Public): Draft page for ISYA 2025.
- Customize your pins:** A link to change the pinned items.
- 843 contributions in the last year:** A heatmap showing weekly contribution activity from November 2023 to November 2024. The heatmap shows a high density of green squares (representing contributions) in the months of March, April, May, June, July, August, September, October, and November, indicating a period of high productivity.
- Contribution settings:** A dropdown menu showing the current year as 2024, with options for 2023, 2022, 2021, 2020, and 2019.

GitHub

Página web

Applets interactivas

Desarrollar applets interactivas y didácticas sobre fenómenos físicos.

3. Con proyectos comunitarios

The image shows a composite screenshot. On the left, the homepage of the **cPhys+** website is displayed, featuring a background image of a starry sky and the text "Studying the Universe through physics and computing". Below this, there are two buttons: "About Us" (dark blue) and "Research" (green). At the top of the page, a navigation bar includes links for Home, About Us, Projects, Research, Team, and Contact. On the right, a screenshot of the GitHub profile for **wbandabarragan** is shown. The GitHub profile includes a bio section for "Wladimir Eduardo Banda Barragán" (he/him), an astrophysicist, with 27 followers and 0 following. It features a pinned section with projects like "computational-physics-1", "quantum-mechanics-1", and "ISYA_2025". A heatmap at the bottom shows contribution activity over the last year.

Recibir solicitudes/contribuciones (código) de la comunidad.

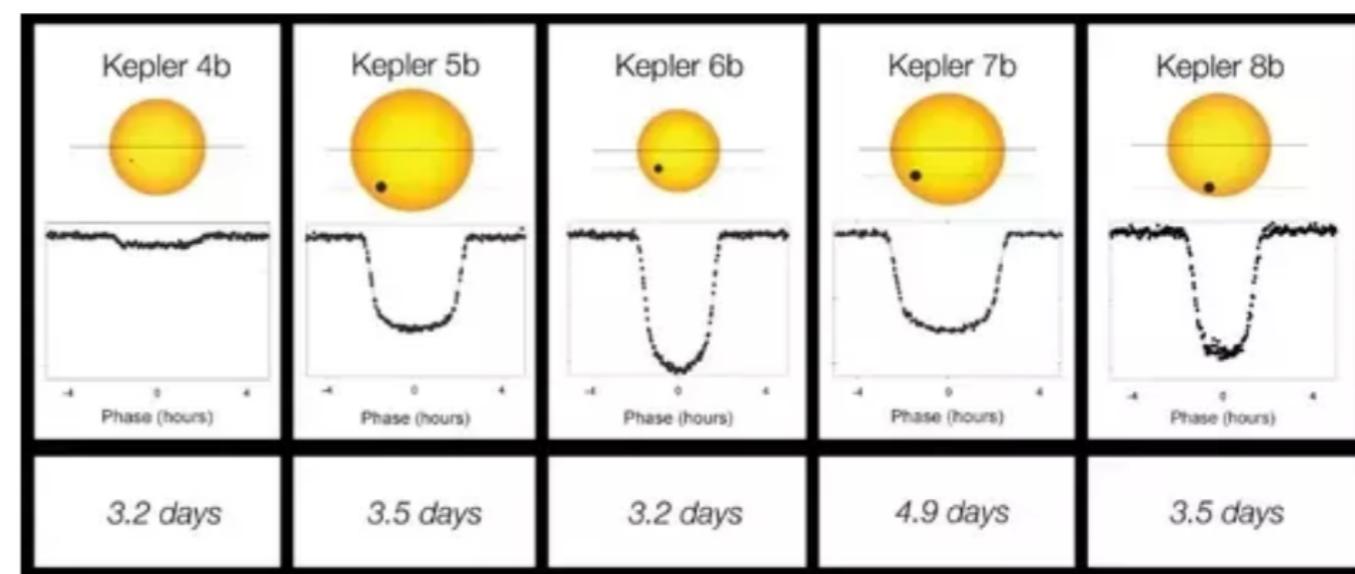
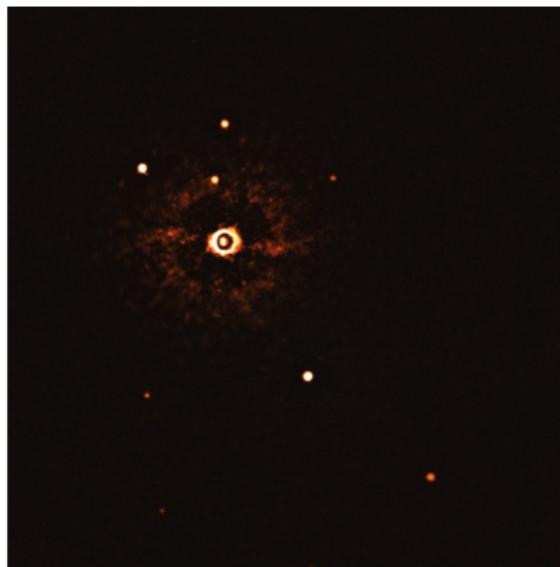
🔭 Physics Applets: Habitable Zones Around Stellar Systems

Terry P. Cevallos-Rios^{1*}, Wladimir E. Banda-Barragán¹

¹School of Physical Sciences and Nanotechnology

*Corresponding author: terry.cevallos@yachaytech.edu.ec

Exoplanet Detection



First direct imaging of multiple exoplanets (2008)

Transit Method

CONCEPTS

Exoplanet: is a planet orbiting a star outside the solar system.

Habitable Zone (HZ): is the region around a star where conditions allow the possible existence of liquid water on the surface of a planet.

T. Effective: is the theoretical average surface temperature of a star.

S. Effective: is the amount of energy per unit area emitted by the surface of the star

Habitable Zone

EQUATIONS

$$d = \sqrt{\frac{L/L_\odot}{S_{\text{eff}}}}$$

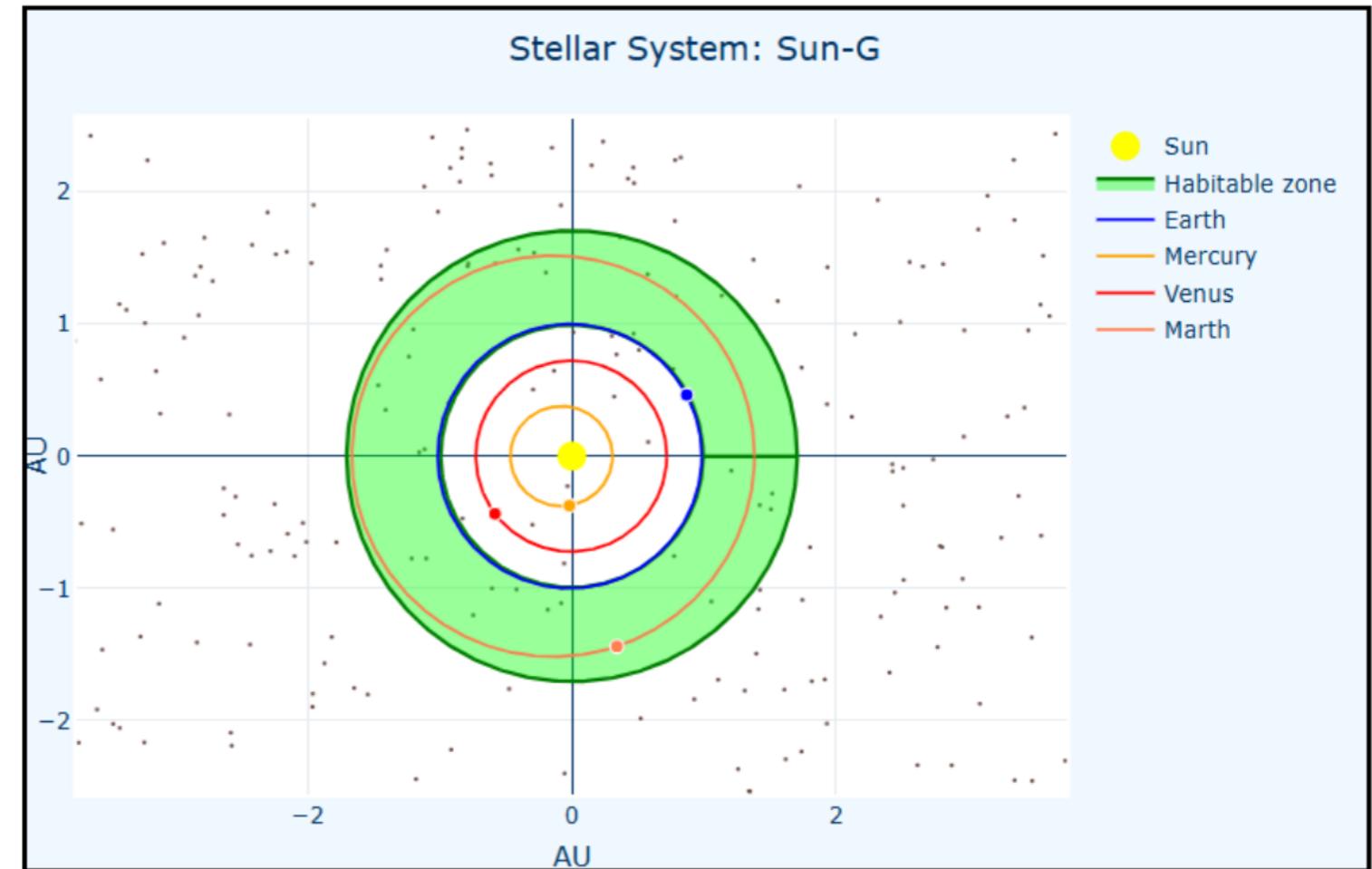


Fig. 1 Habitable zone around the Sun

$$T_* = T_{\text{eff}} - 5780 \text{ K}$$

$$S_{\text{eff}} = S_{\text{eff}\odot} + aT_* + bT_*^2 + cT_*^3 + dT_*^4$$

CONCEPTS

T. Blackbody (To): temperature considering a perfect black body.

T. Equilibrium (Teq): temperature of a planet in radiative equilibrium.

Albedo(A): fraction of light reflected from a surface.

T. Surface (Ts): temperature measured at the planet's surface, influenced by atmosphere and stellar irradiation

greenhouse effect(g): factor quantifies the thermal energy trapped in the atmosphere.

Temperature Profile T(r)

EQUATIONS

$$T_s = T_{\text{eq}} \left(\frac{1}{1-g} \right)^{1/4}$$

$$T_{\text{eq}} = \left(\frac{(1-A)L_{\odot}}{16\pi\sigma a^2} \right)^{1/4}$$

$$T_0 = \left(\frac{L_{\odot}}{16\pi\sigma a_{\oplus}^2} \right)^{1/4}$$

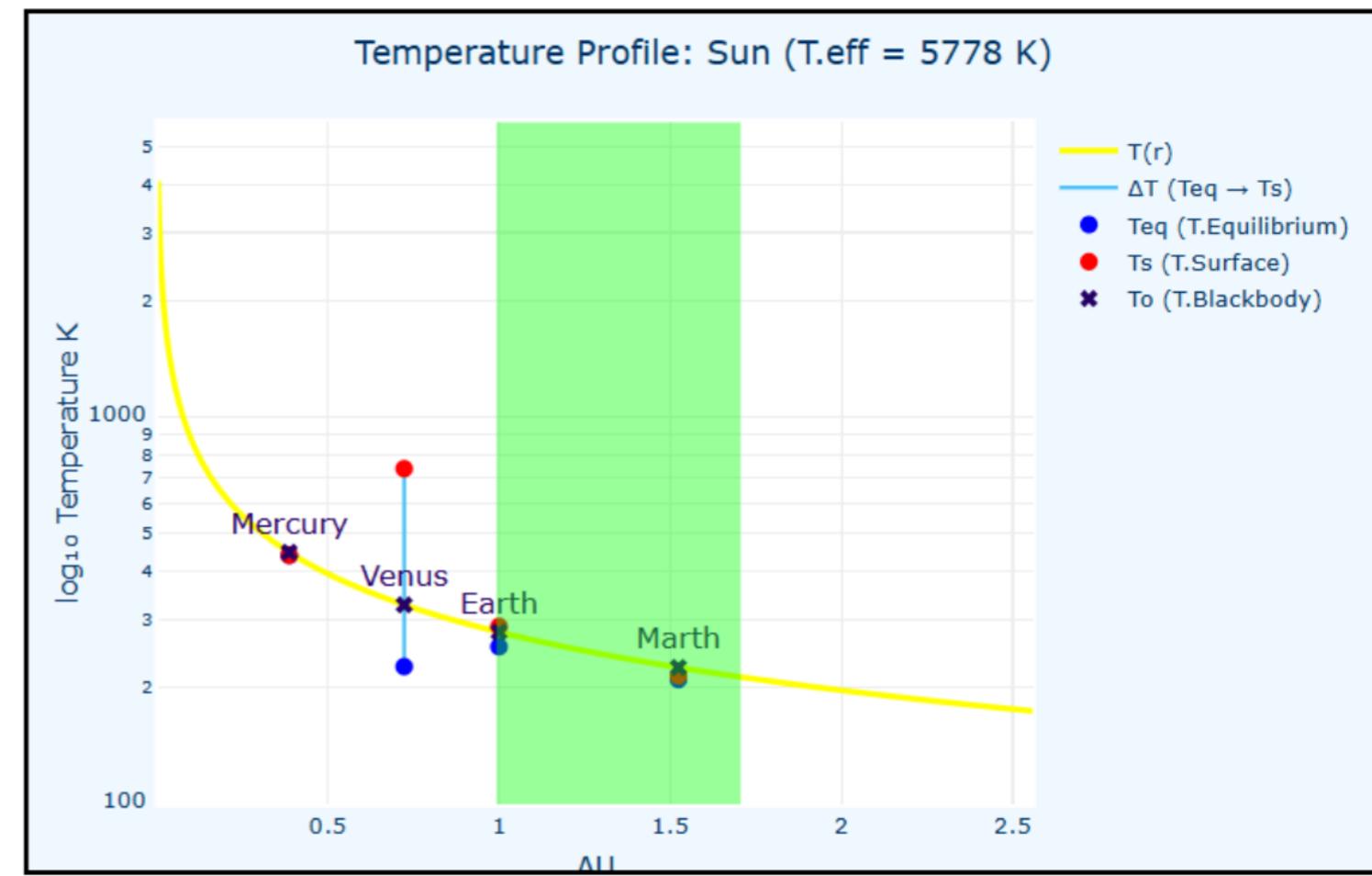


Fig. 2 Location of planets in the sun's temperature profile

Prueba de Concepto

Backend



Código Base

Frontend



Plots/renderizados

JavaScript



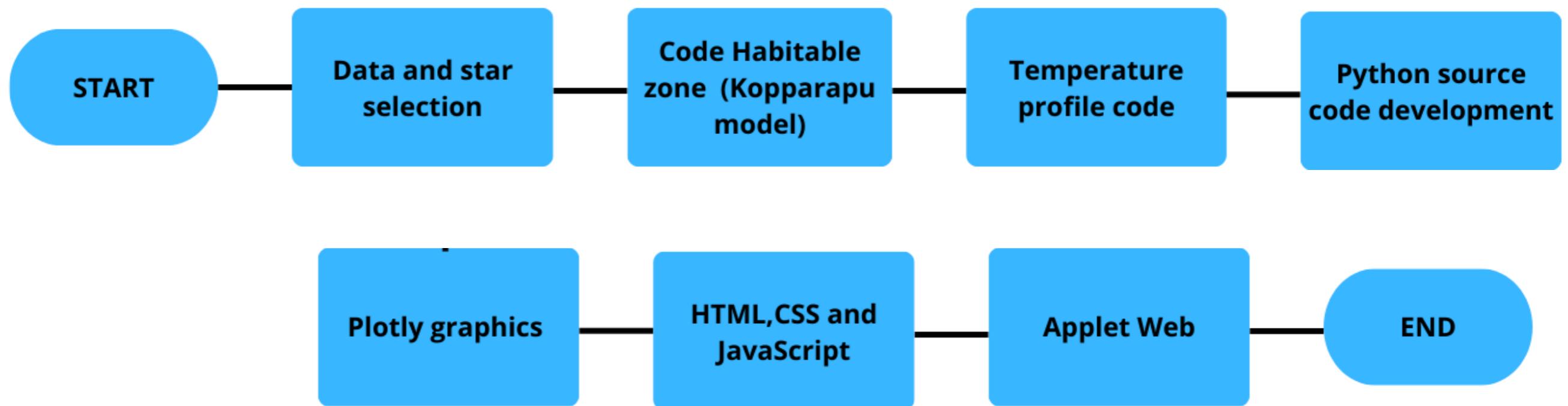
Gráficos Dinámicos

Cálculos

Entradas de Usuario



ALGORHYTHM



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EJEMPLOS