# Comments and Notes on a Custom Catalogue of Exoplanets in Binary Star Systems*

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## 1. Purpose of the Catalogue

The main motivation behind creating this custom catalogue of exoplanets in binary and multiple star systems stems from the limitations of existing databases. While there are several public catalogues available, they often suffer from one or more of the following issues:

- Missing key parameters of the binary system (e.g., stellar masses, separation, orbital elements)
- Outdated or incomplete data, especially for exoplanets that are candidates, controversial, or have been retracted in later studies.
- Lack of a well-structured, spreadsheet-based format that enables immediate filtering, sorting, and further statistical analysis using Python code.

The aim of this effort is to create a **clean, up-to-date, and well-organized Excel spreadsheet**, which includes both stellar and planetary parameters for confirmed systems, drawn directly from the most reliable sources (peer-reviewed literature and updated databases). This resource will serve as a basis for further statistical analysis in the context of my PhD research and may also be useful for any future studies that require a clean and complete dataset of binary star exoplanet systems.

## 2. Data Sources

Although major databases such as the **NASA Exoplanet Archive**, the **Open Exoplanet Catalogue**, and **Exoplanet.eu** were used as entry points for system selection, the actual parameter values were retrieved directly from the primary literature. For each system, I consulted the original peer-reviewed publications to ensure the accuracy, consistency, and contextual reliability of the data.

This approach allowed for more complete and up-to-date information, especially regarding binary configurations, orbital solutions, and notes on controversial or uncertain detections.

*This catalogue is part of my ongoing PhD research on the occurrence and stability of exoplanets in binary star systems.

# 3. Structure of the Catalogue (Excel File)

The dataset is organized in a spreadsheet with two sheets: the first contains the main parameters of each planetary system, while the second includes their corresponding uncertainties (where available), so they can be easily matched and used in scripts or calculations.

If multiple values are found in the literature for the same parameter, the most recent or most reliable one was selected — for example, if a study provides a complete and self-consistent solution for the binary system.

## 3.1 Column Definitions

The first sheet of the Excel file contains 33 columns, each corresponding to a specific property or parameter of the planetary system. Table 1 summarizes their content.

| **Column** | **Description** |
|---|---|
| Folder | Internal folder with the papers |
| Name of the system | Standard name of the planetary system |
| Number of planets in the system | Total number of known planets in the system |
| Number of stars in the system | Number of stellar components |
| Parallax (mas) | Parallax in milliarcseconds, used to compute distance |
| Distance (pc) | Distance to the system in parsecs |
| Name of the planet | Name of the specific planet |
| Type | Classification of the planet (e.g., P-type, S-type) |
| Discovery Method | How the planet was detected |
| Mass (MJ) | Planetary mass in Jupiter masses |
| Orbital period (days) | Planet's orbital period in days |
| Semi-major axis (AU) | Planet's semi-major axis in AU |
| Eccentricity | Orbital eccentricity of the planet |
| Paper | Main literature source used for the planetary parameters |
| Primary Mass ($M_\odot$) | Mass of the primary star in solar masses |
| Secondary Mass ($M_\odot$) | Mass of the secondary star in solar masses |
| $\mu$ | Mass ratio between the stars: $\mu = M_2/(M_1 + M_2)$ |
| Eccentricity for the system | Orbital eccentricity of the binary system |
| Orbital period for the system (days) | Period of the binary system |
| Semi-major axis for the system (AU) | Semi-major axis of the binary (AU); if missing, calculated via Kepler's law |
| Metallicity [Fe/H] (Primary Star) | Metallicity of the primary star |
| Temperature [K] (Primary Star) | Effective temperature of the primary star |
| Spectral type (Primary Star) | Spectral classification of the primary star |
| Metallicity [Fe/H] (Secondary Star) | Metallicity of the secondary star |
| Temperature [K] (Secondary Star) | Effective temperature of the secondary star |
| Spectral type (Secondary Star) | Spectral classification of the secondary star |
| Comments | Notes, caveats, or relevant peculiarities |
| If $\alpha > 100$ AU is 0... | System classifier: 0 = wide ($a > 100$ AU), 1 = multiple without close binary or close binary |
| Projected separation calc. (AU) | Projected separation (AU), calculated when $\alpha$ of the binary system are missing |
| Prob | Classification confidence: Confirmed = 1, Candidate = 0.5, Controversial or Retracted = 0 |
| Projected separation (mas) | Projected angular separation in milliarcseconds (used in Projected separation calc.) |
| Check | Internal flag: 1 if the planet has been manually verified |

Table 1: Description of the columns in the main Excel sheet.

*Note:* In some cases, a cell is left empty to indicate that the value is the same as in the row above (typically for multi-planet systems sharing the same stellar parameters). When a parameter is truly unknown or not reported in the literature, the corresponding cell contains a double dash symbol (‘- -‘).

## 3.2 Color Coding Scheme

Color coding has been used in the spreadsheet to quickly identify notable categories or uncertainties. Below is the description of the color codes applied:

- **Green:** Binary systems hosting a single exoplanet.
- **Blue:** Binary systems with two confirmed exoplanets.
- **Yellow:** Binary systems hosting three or more planets.
- **Orange:** Systems with more than two stars.
- **Red:** A value with a large uncertainty — typically of the same order as the value itself.
- **Gray:** A parameter that includes a $\sin i$ factor (due to unknown orbital inclination).
- **Purple:** An uncertainty value that was estimated or assumed based on typical literature ranges.
- **Light Blue:** Candidate exoplanets — classification is not yet fully confirmed.
- **Dark Blue:** Controversial or retracted exoplanets — systems with conflicting publications or reclassification.

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