Reference guide to Stellar System Creator

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1 Introduction

The Solar System Creator is a python package that aims to ease the creation of realistic solar systems in sci-fi settings. With minimal input, the user is able to create stars, planets, moons, asteroid regions, with accurate physical characteristics, declare their habitability, extract physical characteristics and visualize them.

1.1 Disclaimer

In this package:

1. The galactic neighborhood of the solar systems is not taken into account for solar/planetary system habitability declaration.
2. The universe's time is not taken into account for solar/planetary system habitability declaration.
3. The habitability of solar/planetary system is not dependent on a specific time of the star's life.
4. The size of the star and it's luminosity are calculated at the star's most stable timeframe, and through the luminosity-mass-radius relations of the main sequence (no fancy stars).
5. The habitable zone uses semi-conservative limits and assumes carbon based lifeforms that need water and oxygen.

All the aforementioned assumptions were made since most sci-fi settings use human-like environments.

1.2 Future

In future releases we will try to tackle the aforementioned assumptions and enlarge the scope of the project to include less familiar solar systems.

2 Solar System Elements

2.1 Stellar Bodies

Stellar bodies are one of the most important class in this project. The base class 'stellar body' is the building block for solar system elements like stars, planets, moons and asteroids.

2.1.1 Star

Stars can be given the following arguments:

1. Reference name (the name we will use to refer to the object as),

2. Mass (The mass that will be used for calculation of various physical characteristics, like radius and luminosity),

3. Radius (even though the program is designed to calculate the radius of the star by it's mass, one can force to radius to whatever they want it to be. My suggestion is that you can vary this value by $\pm 5\,\%$ of the suggested value, but not more),

4. Luminosity (similarly with Radius, this parameter will force the value of luminosity to the users input. Again, stay within $\pm 5\,\%$ of the suggested calculated luminosity value),

5. Unit reference (the unit family which will be used for outputting information),

6. Parent (if this star is part of a binary system, you can assign the binary system as the parent object of this star),

7. Eccentricity (if this star is part of a binary system, you must assign the eccentricity of the star in the binary system).

Values that are calculated or assigned for the star are:

Characteristics	Creation action	Values	Examples	
name	input	name	AndraStar	
unit_reference	input	unit reference	Sol	
mass	input	input number	1.4	so
parent	input	input parent name	None	
farthest_parent	output	farthest parent name	None	
eccentricity	input	number	0.5	
suggested_radius	output	number	1.28	s
radius	input or output	number	1	s
suggested_luminosity	output	number	3.84	sola
luminosity	input or output	number	3.84	sola
temperature	output	number	8.09E+03	
circumference	output	number	6.28	s
surface_area	output	number	12.6	sq
volume	output	number	4.19	sq
density	output	number	1.97	
inner_orbit_limit	output	number	0.14	
outer_orbit_limit	output	number	56	
frost_line	output	number	9.51	
distance_to_binary_barycenter	output	number	nan	
minimum_distance_to_binary_barycenter	output	number	nan	
maximum_distance_to_binary_barycenter	output	number	nan	
mass_class	output	class name	A	
habitable_zone_minimum	output	number	1.86	
habitable_zone_maximum	output	number	2.69	
habitable_zone_earth_equivalent	output	number	1.96	
hill_sphere	output	number	1.31E+06	
habitability	output	true or false	TRUE	
habitability_violations	output	sentences		
luminosity_class	output	class name	V	
appearance_frequency	output	number	0.006	probabi
lifetime	output	number	0.364	sol
peak_wavelength	output	number	358	

Table 1: diphthongs