SIMPLE Documentation

Release 0.1.2

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CONTENTS

Contents: Useful classes and functions for SIMPLE.

`simple_lib.impact_parameter`(*a*, *e*, *i*, *w*, *r_star*)

Compute the impact parameter at for a transiting planet.

Parameters **a** : int, float or numpy array

Semimajor axis of planet's orbit in AU

e : int, float or numpy array

Eccentricity of planet. WARNING! This function breaks down at high eccentricity (>> 0.9), so be careful!

i : int, float or numpy array

Inclination of planet in degrees. 90 degrees is edge-on.

w : int, float or numpy array

Longitude of ascending node defined with respect to sky-plane.

r_star : int, float or numpy array

Radius of star in solar radii.

Returns **b** : float or numpy array

The impact parameter, ie transit latitude in units of stellar radius.

Notes

Using Eqn. (7), Chap. 4, Page 56 of Exoplanets, edited by S. Seager. Tucson, AZ: University of Arizona Press, 2011, 526 pp. ISBN 978-0-8165-2945-2.

Examples

```
>>> impact_parameter(1, 0, 90, 0, 1)
1.3171077641937547e-14
>>> a = np.linspace(.1, 1.5, 3)
>>> e = np.linspace(0, .9, 3)
>>> i = np.linspace(89, 91, 3)
>>> w = np.linspace(0, 360, 3)
>>> r_star = np.linspace(0.1, 10, 3)
>>> impact_parameter(a, e, i, w, r_star)
array([  3.75401300e+00,   1.66398961e-15,   1.06989371e-01])
```

`simple_lib.inclination`(*fund_plane*, *mutual_inc*, *node*)

Compute the inclination of a planet.

Uses the law a spherical cosines to compute the sky plane of a orbit given a reference plane inclination, angle from reference plane (ie mutual inclination) and a nodal angle.

Parameters **fund_plane: int, float or numpy array** :

Inclination of of the fundamental plane of the system in degrees with respect to the sky plane 90 degrees is edge-on.

mutual_inc : int, float or numpy array

Angle in degrees of the orbital plane of the planet with respect to the fundamental plane of the system.

node : int, float or numpy array

Rotation in degrees of the planet's orbit about the perpendicular of the reference plane. I.e. the longitude of the node with respect to the reference plane.

Returns i : float or numpy array

The inclination of the planet's orbit with respect to the sky plane.

Notes

See eqn. () in

Examples

```
>>> inclination(90, 3, 0)
87.0
>>> fun_i = np.linspace(80, 110, 3)
>>> mi = np.linspace(0, 10, 3)
>>> node = np.linspace(30,100,3)
>>> inclination(fun_i, mi, node)
array([  80.        ,   92.87347869,  111.41738591])
```

simple_lib.**semimajor_axis**(*period*, *mass*)

Compute the semimajor axis of an object.

This is a simple implementation of the general form Kepler's Third law.

Parameters period : int, float or numpy array

The orbital period of the orbiting body in units of days.

mass : int, float or array-like

The mass of the central body (or mass sum) in units of solar mass.

Returns a : float or numpy array

The semimajor axis in AU.

Examples

```
>>> semimajor_axis(365.256363,1.00)
0.999985270598628

>>> semimajor_axis(np.linspace(1, 1000, 5),np.linspace(0.08, 4, 5))
array([ 0.00843254,  0.7934587 ,  1.56461631,  2.33561574,  3.10657426])
```

simple_lib.**transit_depth**()

One-line description

Full description

simple_lib.**transit_duration**(*p*, *a*, *e*, *i*, *w*, *b*, *r_star*, *r_planet*)

Compute the full (Q1-Q4) transit duration.

Full description

Parameters p : int, float or numpy array

Period of planet orbit in days

a : int, float or numpy array

Semimajor axis of planet's orbit in AU

e : int, float or numpy array

Eccentricity of planet. WARNING! This function breaks down at high eccentricity (>> 0.9), so be careful!

i : int, float or numpy array

Inclination of planet in degrees. 90 degrees is edge-on.

w : int, float or numpy array

Longitude of ascending node defined with respect to sky-plane.

b : int, float or numpy array

Impact parameter of planet.

r_star : int, float or numpy array

Radius of star in solar radii.

r_planet : int, float or numpy array

Radius of planet in Earth radii

Returns **T** : float or numpy array

The Q1-Q4 (full) transit duration of the planet in hours.

Notes

Using Eqns. (15) and (16), Chap. 4, Page 58 of Exoplanets, edited by S. Seager. Tucson, AZ: University of Arizona Press, 2011, 526 pp. ISBN 978-0-8165-2945-2.

CHAPTER

ONE

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