# SIMPLE Documentation

***Release 0.1.1***

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March 19, 2014

# 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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