Package 'CRAC'

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Type Package

Title Cosmology R Analysis Code

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Description R functions for cosmological research.
The main functions are similar to the python library, cosmolopy.

License GPL (>= 2)

References [H99] Hogg 1999, http://arxiv.org/abs/astro-ph/9905116
[PDG] Particle Data Group,
http://pdg.lbl.gov/2013/reviews/contents_sports.html

NeedsCompilation no

Repository CRAN

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R topics documented:

`distance.angular` *compute the angular diameter distance [Mpc/h]*

Description

ONLY FOR flat universe, $\Omega_{\mathbf{k}} = 0$.

Usage

```
distance.angular(z, cosmo, z0 = 0, ...)
```

Arguments

`z`	redshift upper limit
`cosmo`	cosmological parameter list
`z0`	redshift lower limit
`...`	pass to integrate() to control integration accuracy.

Value

Angular diameter distance from $z_0(=0)$ to z [Mpc/h]

References

Equation (18) in [H99]

See Also

`distance.comoving`

Examples

```
distance.angular(0.1,parameter.fidcosmo)
distance.angular(0.3,list(omegaM0=0.272,omegaL0=0.728,omegaK=0.0,h=0.704))
```

distance.comoving *compute the comoving distance (line-of-sight) [Mpc/h]*

Description

compute the comoving distance (line-of-sight) [Mpc/h]

Usage

```
distance.comoving(z, cosmo, z0 = 0, ...)
```

Arguments

z	redshift upper limit
cosmo	cosmological parameter list
z0	redshift lower limit
...	pass to integrate() to control integration accuracy.

Value

Comoving distance from $z_0(=0)$ to z to z [Mpc/h]

References

Equation (15) in [H99]

Examples

```
distance.comoving(0.2,parameter.fidcosmo,z0=0.3)
sapply(seq(0,1,0.1),function (x) distance.comoving(x,parameter.fidcosmo))
```

distance.luminosity *Compute the luminosity distance [Mpc/h]*

Description

Compute the luminosity distance [Mpc/h]

Usage

```
distance.luminosity(z, cosmo, z0 = 0, ...)
```

Arguments

z	redshift upper limit
cosmo	cosmological parameter list
z0	redshift lower limit
...	pass to integrate() to control integration accuracy.

Value

Luminosity distance from $z_0(=0)$ to z [Mpc/h]

References

Equation (20) in [H99]

See Also

distance.angular,distance.comoving

Examples

```
distance.luminosity(0.1,parameter.fidcosmo)
```

---

distance.transverse *compute the comoving distance (transverse) [Mpc/h]*

Description

compute the comoving distance (transverse) [Mpc/h]

Usage

```
distance.transverse(z, cosmo, z0 = 0, ...)
```

Arguments

z	redshift upper limit
cosmo	cosmological parameter list
z0	redshift lower limit
...	pass to integrate() to control integration accuracy.

Value

Comoving distance from $z_0(=0)$ to z [Mpc/h]

References

Equation (16) in [H99]

See Also

distance.comoving

Examples

```
distance.transverse(0.1,parameter.fidcosmo)
```

---

eZ *compute E(z) of given cosmology*

Description

Compute the $E(z) = H(z)/H_0$, or

$$E(z) \equiv \sqrt{\Omega_{\mathbf{M}}(1+z)^3 + \Omega_{\mathbf{k}}(1+z)^2 + \Omega_{\Lambda}(1+z)^{(1+w)}}, where we omit the radiation component.$$

Usage

```
eZ(z, cosmo)
```

Arguments

z	Redshift
cosmo	cosmology parameter list, contains 'omegaM0', 'omegaL0', 'omegaK'

Value

The dimentionless Hubble constant $H(z)/H_0$

References

Equation (14) in [H99]

See Also

eZ2,parameter.fidcosmo

Examples

```
eZ(1.2,parameter.fidcosmo)
```

eZ2 *compute E^2(z) of given cosmology*

Description

Compute the $E^2(z) = (H(z)/H_0)^2$

Usage

```
eZ2(z, cosmo)
```

Arguments

z	Redshift
cosmo	cosmology parameter list, contains 'omegaM0', 'omegaL0', 'omegaK'

Value

The dimentionless Hubble constant $H(z)/H_0$

References

Equation (14) in [H99]

See Also

eZ

Examples

```
eZ2(1.2,parameter.fidcosmo)
```

parameter.constant *Physical constants in SI units, source: [PDG]*

Description

Useful physical constants in SI units.

Usage

```
parameter.constant
```

Format

```
List of 8
 $ c      : num 3e+08
 $ me     : num 9.11e-31
 $ h      : num 6.63e-34
 $ mp     : num 1.67e-27
 $ e      : num 1.6e-19
 $ G      : num 6.67e-11
 $ k      : num 1.38e-23
 $ sigma.T: num 6.65e-29
```

---

parameter.DH *Hubble Distance $D\_H = c/H\_0$ [Mpc/h]*

Description

Hubble Distance $D_H = c/H_0$ [Mpc/h]

Usage

```
parameter.DH
```

Format

```
num 2998
```

---

parameter.fidcosmo *Fiducial cosmology parameter list*

Description

the parameter list is a crucial input for other calculations

Usage

```
parameter.fidcosmo
```

Format

```
List of 4
 $ omegaM0: num 0.3
 $ omegaL0: num 0.7
 $ omegaK : num 0
 $ h      : num 0.7
```

parameter.unit *useful conversion of astrophysical units*

Description

useful conversion of astrophysical units

Usage

```
parameter.unit
```

Format

```
List of 3
 $ Mpc : num 3.09e+22
 $ Msun: num 1.99e+30
 $ eV  : num 1.6e-19
```

rhoc *calculate the critical density at redshift z*

Description

calculate the critical density at redshift z

Usage

```
rhoc(z, cosmo)
```

Arguments

z	redshift
cosmo	cosmological parameter list return the critical densith at given redshift in $h_0^2 \mathrm{kg}/\mathrm{m}^3]$

Examples

```
# get the critial density at z=0
 rhoc(0,parameter.fidcosmo)
```

valid.cosmo *validate the cosmologial parameters are enough*

Description

validate the cosmological parameter list is complete for other usage. If missing data detected, it will be filled with fiducial value. Also the warning message is printed in red for *nix enviroment.

Usage

```
valid.cosmo(cosmo)
```

Arguments

cosmo	cosmological parameter list

Value

the cosmo list will be updated if important variables are missing

See Also

parameter.fidcosmo

Examples

```
# there are two typos in the cosmology parameter list
a <- list(omegaM=0.272,omegaL0=0.728,omegaK=0.0,h0=0.704)
valid.cosmo(a)
print(a)
```

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