

DiskParams

DiskParams [*a*, α , *m*, *mdot*, Options]

returns an association containing information about accretion disk's radiation. The keys are 'Temperature', 'SpectralFluxDensity' and 'FluxDensity'.

The function takes the arguments *a*, the dimensionless angular momentum, the constant characterizing the efficiency of angular momentum transport α , the black hole mass *M*, the mass influx *mdot* and an options pattern.

The following options can be given:

"InputUnits" "NovikovThorne"

This option specifies the units in which the user has provided the input. The default option is "InputUnits"→"NovikovThorne", which expects the mass *M* to be given in geometrized units and the mass influx *mdot* to be dimensionless, $\dot{m} := \dot{M}/10^{14} \text{ kg/s}$. Other accepted options are "InputUnits"→"SI", "InputUnits"→"CGS", and "InputUnits"→"ShakuraSunyaev", the first two expecting SI and CGS units respectively, the last one expecting *M* to be given in solar masses and *mdot* to be given in multiples of the critical mass influx; the mass influx at which the Eddington luminosity is reached.

"OutputUnits" "SI"

This option changes the units of the output functions (temperature and flux density). As of June 2024, only the default option "OutputUnits"→"SI" is supported.

"rUnits" "BHMass"

The output functions of DiskParams are functions of radius. This option changes the units of radius these functions expect. The default option is "rUnits"→"BHMass", which expects the dimensionless *r* used throughout chapters 1 and 2, $r = Rc^2/(GM)$, where *R* is radius with dimension. Other supported options are "rUnits"→"SI", "rUnits"→"CGS", and "rUnits"→"ShakuraSunyaev", the first two using the meters and centimeters as units respectively, and the last one using Shakura and Sunyaev's definition, $r = Rc^2/(6GM)$.

The output of the DiskParams function is an association with the following keys:

"Temperature"

This returns the surface temperature of the disk as a function of the radius.

"SpectralFluxDensity"

This returns the spectral flux density of the disk's radiation as a function of the radiation's frequency and the radius.

"FluxDensity"

This returns the integrated flux density over the spectrum as a function of the radius.

"PeakFrequency"

This returns the frequency of the radiation at the peak of the spectral flux density at a given radius.

"rDefinition"

This returns a factor by which the input must be multiplied if it is provided in the black hole mass units. This is relevant for communication with other functions of the package but can be largely ignored by the user.

"rISCO"

This returns the radius of the innermost stable circular orbit in the black hole's mass multiples (geometrized units).

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Generate the functions of the accretion disk with $\alpha = 0.1$ and an influx of 10^{14} kg/s around a black hole with a solar mass and the spin parameter $a = 0.1$:

```
In[6]:= disk = DiskParams[0.6, 0.1, 1500, 1];
```

Get the peak frequency at $r = 10\,000$ m:

```
In[7]:= disk["PeakFrequency"][10000]
```

```
Out[7]= 3.00107 × 1015
```

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