

CYGNUS (CYprus models for Galaxies and their NUClear Spectra)

AGN tapered disc models

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The AGN torus models are described in more detail in Efstathiou & Rowan-Robinson (1995) and Efstathiou et al. (2013). The models form part of the CYGNUS collection of models (<http://ahpc.euc.ac.cy/index.php/resources/cygnus>).

The AGN torus model spectra are contained in the IDL structure `agn_models`. In IDL type for example

```
IDL>restore, 'tapered_discs_4d_ir1.dat',/v
```

The library contains model spectra for both a direct view of the central source (Type 1 AGN) and for a completely obscured central source (Type 2 AGN).

To create a structure of only 'type 2' or 'edge-on' views, select the models with `theta_v < theta_1`. Similarly to select the models with only 'type 1' or 'face-on' views, select the models with `theta_v > theta_1`.

e.g. in IDL

```
IDL> restore, 'tapered_discs_4d_ir1.dat',/v
IDL> type1=where(agn_models.theta_v gt agn_models.theta_1)
IDL> agn_models_type1=agn_models(type1)
```

The structure has the following fields which are explained below:

THETA_1	FLOAT	15.0000
THETA_V	FLOAT	1.23350
TUV_EQ	FLOAT	250.000
R1TOR2	FLOAT	0.0500000
HTOR2	FLOAT	0.500000
T1	FLOAT	1000.00
BETA	FLOAT	1.00000
ANISO	FLOAT	18.4896

```
EXTRA      STRING 'TH15R020t0250'  
SPECTRUM   STRUCT -> <Anonymous> Array[60]
```

Where

- 90 - THETA_1 is the opening angle of the disc in degrees (Efstathiou & Rowan-Robinson 1995)
- THETA_V is the viewing angle measured from the equatorial plane in degrees
- TUV_EQ is the equatorial optical depth at 1000 Angstrom (the A_v is about TUV_EQ/5)
- R1TOR2 is the ratio of inner to outer disc radius
- HTOR2 is the ratio of height to outer radius
- T1 is the maximum temperature of the large grains (fixed at 1000K)
- BETA is the density power-law index (fixed at 1)
- ANISO is the anisotropy correction factor A (as defined in Efstathiou 2006) for the particular model and view THETA_V. The 'apparent luminosity', which is usually derived by integrating the best fit model over frequency and taking account of the distance, should be multiplied by this factor to give the intrinsic AGN luminosity (see for example Efstathiou et al. 2014). In general for edge-on views $A > 1$ and for face-on views $A < 1$. Note that ANISO is not a model parameter but a quantity that is derived from the particular radiative transfer solution.
- SPECTRUM is a structure within a structure that gives the wavelength grid (in microns) and nuSnu (in model units - see below).

The models are normalized so that the intrinsic bolometric luminosity of a torus (i.e. the flux integrated over frequency but also over viewing angle to take into account the anisotropy of the emission e.g. Efstathiou & Rowan-Robinson 1995) is equal to unity.

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References

Efstathiou, A., & Rowan-Robinson, M., 1995, MNRAS, 273, 649

Efstathiou, A., 2006, MNRAS, 371, L70
Efstathiou, et al., 2013, MNRAS, 436, 1873
Efstathiou, et al., 2014, MNRAS, 437, L16