

## apec, vapec: APEC emission spectrum

An emission spectrum from collisionally-ionized diffuse gas calculated using the APEC code v1.3.1. More information can be found at

<http://hea-www.harvard.edu/APEC>

which should be consulted by anyone running this model. By default this model reads atomic physics continuum and line data from the files `apec_v[version]_coco.fits` and `apec_v[version]_line.fits` in the `$HEADAS/./spectral/modelData` directory. Different files can be specified by using the command `xset APECROOT`. There are three options. `APECROOT` can be set to a version number (eg 1.10, 1.2.0, 1.3.1). In this case the value of `APECROOT` will be used to replace 1.3.1 in the name of the standard files and the resulting files will be assumed to be in the `modelData` directory. Alternatively, a filename root (eg `apec_v1.2.0`) can be given. This root will be used as a prefix for the `_coco.fits` and `_line.fits` files. Finally, if neither of these work then the model will assume that the `APECROOT` value gives the complete directory path, e.g.

```
XSPEC12> xset APECROOT /foo/bar/apec_v1.2.0
```

will use the input files

```
/foo/bar/apec_v1.2.0_coco.fits
```

```
/foo/bar/apec_v1.2.0_line.fits.
```

Thermal broadening of lines can be included by using: `xset APECTHERMAL yes`. This runs significantly slower than the option without thermal broadening so you should only use this when necessary. Velocity broadening of lines can be included by using: `xset APECVELOCITY <velocity>`, where `<velocity>` is in km/s. This is added in Gaussian quadrature with any thermal broadening in use.

The **apec** model uses abundances set by the **abund** command. The **vapec** variant allows the user to set the abundance using additional parameters.

par1	plasma temperature, keV
par2	Metal abundances (He fixed at cosmic). The elements included are C, N, O, Ne, Mg, Al, Si, S, Ar, Ca, Fe, Ni. Relative abundances are set by the <b>abund</b> command.
par3	Redshift, $z$
norm	$\frac{10^{-14}}{4\pi[D_A(1+z)]^2} \int n_e n_H dV$ , where $D_A$ is the angular diameter distance to the source (cm), $n_e$ and $n_H$ are the electron and H densities ( $\text{cm}^{-3}$ )

For the **vapec** variant the parameters are as follows.

par1	plasma temperature, keV
par2-	Abundances for He, C, N, O, Ne, Mg,Al, Si, S, Ar, Ca, Fe, Ni
par14	wrt Solar (defined by the abund command)
par15	redshift, $z$
norm	$\frac{10^{-14}}{4\pi[D_A(1+z)]^2} \int n_e n_H dV$ , where $D_A$ is the angular diameter distance to the source (cm), $n_e$ and $n_H$ are the electron and H densities (cm <sup>-3</sup> )