ROSAT related software at IAAT

1 Manipulation of object data bases

There have been written several utilities to calculate luminosity densities and broad band spectral indices of extragalactic objects.

The programs are written in FORTRAN and do calculations on MIDAS tables.

1.1 Luminosity densities

Methods:

The luminosity density is an objects source frame luminosity per frequency interval at a specified frequency.

$$L_\nu(\nu) = \frac{\mathrm{d}P}{\mathrm{d}t\mathrm{d}\nu}$$

The flux density as measured in the observers frame is

In order to calculate a source frame *luminosity density* from an observer frame *flux density* the following effects have to be taken into account:

- The flux densities have to be corrected for absorption along the line of sight (e.g. dust extinction, photoelectric absorption).
- When continuum luminosity densities of emission line objects are calculated, the line fluxes must be subtracted from broad band flux measurements.
- The luminosity distance D_L of the object has to be calculated from its redshift. The calculation depends on the value of the Hubble constant H_0 and of the deceleration parameter q_0. In the programs discussed here the values $H_0 = 50\ \mathrm{km\ s^{-1}\ Mpc^{-1}}$ and $q_0 = 0$ are assumed. For $q_0 = 0$ the expession for the luminosity distance is

  $$D_\mathrm{L} = \frac{c}{H_0} z(1 + \frac{z}{2})$$

- Radiation emitted in the source frame frequency interval $\mathrm{d}\nu$ is measured in the observer frame interval

  $$\mathrm{d}\nu' = \mathrm{d}\nu \frac{1}{(1+z)}.$$

  Therefore a factor $(1+z)$ has to applied when calculating source frame luminosities from observer frame fluxes (often referred to as *k-correction*).

- In case L_ν has to be calculated for a frequency ν_ref not equal to $\nu_\mathrm{source} = \nu_\mathrm{observed}$, its value has to extrapolated using

  $$L_\nu(\nu_\mathrm{ref}) = L_{\nu_\mathrm{source}} (\frac{\nu_\mathrm{ref}}{\nu_\mathrm{source}})^{-\alpha}$$

  with the measured or assumed spectral energy index α, ($f_\nu \propto \alpha^{-1}$).

The programs described below calculate the logarithms of luminosity densities in units of erg/(s Hz).

Programs:

RADTOFD:

Source code: `[ROSAT.SURVEY.CODE]radtofd.fom`
Command file: `[ROSAT.WORK.UTILS]radtofd.prg`

Purpose:
`RADTOFD` calculates log. luminosity densities from radio fluxes or other flux values given in Jy and not to be corrected for any absorption (e.g. ROSAT 1 keV flux densities).

Parameters:
(to be inserted in the command file `radtofd.prg`)
MIDAS table name
Name of result column
Observed radio flux density
Name of redshift column
(Assumed) radio powerlaw index
Frequency of observed flux density [MHz]
Source frame frequency of lum. density

Usage:
Midas 001> `@@ radtofd`

OPTTOFD

Source code: `[ROSAT.SURVEY.CODE]opttofd.fom`
Command file: `[ROSAT.WORK.UTILS]opttofd.prg`

Purpose:
Calculation of log. luminosity densities of quasars from U, B or V magnitudes following *Zamorani et al. 1981, ApJ 245, 357* and *Marshall et al. 1983, ApJ 269, 42*. Average emission line fluxes for quasars are subtracted and corrections for reddening are applied. A column `:NH` with hydrogen column densities has to be present in the MIDAS table.

Parameters:
(to be inserted in the command file `opttofd.prg`)
MIDAS table name
Name of result column
magnitude band: U, B, or V
Name of magnitude column
Name of redshift column
Assumed energy index
Reference source frame wavelength [$\AA$]

Usage:
Midas 001> `@@ opttofd`

`UVTOFD:`

Source code: `[ROSAT.SURVEY.CODE]uvtofd.fom`
Command file: `[ROSAT.WORK.UTILS]uvtofd.prg`

Purpose:
Calculation of luminosity densities from UV fluxes (e.g. IUE data) given in Jy. Dereddening is performed using methods from *Seaton et al. 1979, MNRAS 187, 73* and *Bohlin et al. 1978, ApJ 224, 132*.

Parameters:
(to be inserted in command file `uvtofd.prg`)
Name of MIDAS table
Name of result column
Name of input flux density column
Name of N_{H} column
Name of redshift column
Assumed energy index
Frequency of observed flux density
Source frame frequency of luminosity density

Usage:
Midas 001> `@@ uvtofd`

`ALPHAXY`

Source code: `[ROSAT.SURVEY.CODE]alphaxy.fom`
Command file: `[ROSAT.WORK.UTILS]alphaxy.prg`

Purpose:
Calculates two point spectral indices from two logarithmic luminosity density values.

Parameters:
(to be inserted in command file `alphaxy.prg`)
Name of MIDAS table
Name of result column
Name of input column 1 Name of input column 2
Frequency 1
Frequency 2

Usage:
Midas 001> `@@ alphaxy`

2 Statistics

`DISTPAR`

Source code: `[ROSAT.SURVEY.CODE]distpar.fom`
Command file: `[ROSAT.WORK.UTILS]distpar.prg`

Purpose:
Calculate maximum likelihood (ML) confidence contours following *Avni 1976, ApJ, 210, 641* for the *intrinsic* mean value and the *intrinsic* scatter of any parameter in a sample of objects. The measured values and their 1 σ errors have to present in a MIDAS table. A two dimensional grid of $S = -lnL$ values is written into a MIDAS image, specified confidence contours can be plotted. See also PhD thesis Lamer 1996 p 32/33.

Parameters:
(to be inserted in command file `distpar.prg`)
Name of MIDAS table
Name of result MIDAS image
Name of input data column
Name of input error column
Lower boundary of mean
Upper boundary of mean
Lower boundary of sigma
Upper boundary of sigma

Usage:
Midas 001> `@@ distpar`

3 Galactic N_{H} values

Source code: `[ROSAT.SURVEY.CODE]stark.fom`

Purpose:
Extracts galactic neutral Hydrogen column densities N_{H} from the database `[ROSAT.SURVEY.TAB]hydro.map` . The values are given in units of cm^{-2}.

Usage:
`set/def tab` (sets default directory to [ROSAT.SURVEY.TAB])
`run scod:stark`
You will be prompted to type in RA and DEC (1950.0)
Quit the program by typing `00 00 00 00`