THERMAL X-RAY EMISSION CODE

Spring 1989

A call to the subroutine FELINE generates the X-ray spectrum and places it in array BIN. The main program XSPCT is provided as an example of the calling sequence.

Input needed:

- Parameters passed by COMMON BLOCK /PARAMS/:

  NBIN Number of bins. ≤ 1000.

  BINMIN Energy of lower edge of first BIN in eV.

  BINSYZ Width of each BIN in eV.

  ABUNJ Elemental abundances: Logarithmic with H = 12.0. The values must correspond to the abundances in the order read in from ATOMIC.DAT. This version includes 12 elements besides H. The elements with atomic numbers and Allen abundances are:

1	He	2	10.93
2	C	6	8.52
3	N	7	7.96
4	O	8	8.82
5	Ne	10	7.92
6	Mg	12	7.42
7	Si	14	7.52
8	S	16	7.20
9	Ar	18	6.90
10	Ca	20	6.30
11	Fe	26	7.60
12	Ni	28	6.30

- Optional Parameters passed by COMMON BLOCK /BLN/. If NBLN is not 0, you will get a spectrum in wavelength bins.

  NBLN Number of BLNs. ≤ 1000.

  BLNMIN Lower edge of first BLN in Angstroms.

  BLNSYZ Width of each BLN in Angstroms.

  Note: The continuum is computed in energy bins, then converted to wavelength bins, so the energy range of the BINs must span that of the BLNs, though the resolution need not be high. That is,

$$12399./BLNMIN < BINMIN + NBIN*BINSYZ$$

  and

$$12399./BINMIN > BLNMIN + NBLN*BLNSYZ.$$

  If you don't need wavelength bins, set NBLN to zero and ignore.

- **RHY** The ratio of ionized to neutral hydrogen is passed by COMMON BLOCK /RESULT/. See the four lines in XSPCT which compute RHY in ionization equilibrium.

- FELINE Parameters:

T		Temperature: Kelvin
DENE		Density: cm^{-3}
NUM		Number of elements to include: no more than 12.
IPRINT	**= 0**	Prints nothing.
	= 1	Prints abundance, temperature, ionization balance.
	= 2	Prints above + wavelengths and emissivities of strong lines.
	= 3	Prints above + ionization and recombination rates.
JPRINT	**= 0**	Prints nothing.
	= 1	Prints BINS and bremsstrahlung, recombination and two-photon continua.
ICONT	**= 0**	Ionization Equilibrium.
	= 1	Non-equilibrium. Ionization fractions must be supplied through CNC.
IPHOT	**= 0**	No photoionization.
	= 1	Photoionization. Requires PHOT and APHOT which you probably don't have.
IDENS	**= 0**	No density dependence of dielectronic recombination, no ionization from metastable levels.
	= 1	Includes above. Significant above 10^7 cm^{-3} in EUV, 10^{11} in X-rays.
ICX	**= 0**	No charge transfer.
	= 1	Includes charge transfer; 1% effect at 10^6 K.

Atomic data is read from ATOMIC.DAT by a call to ATREAD. On a VAX you can just

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$ASSIGN ATOMIC.DAT FOR$READ
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before running XSPCT.

Other bits of information:

- The wavelength resolution of the BLNs can be as good as the wavelengths listed in ATOMIC.DAT. The limitation is that multiplets are generally treated as single lines, though the resonance doublets of Li-like and Na-like ions are split up into individual lines. Many strong lines of He-, Be-, Ne-, and Mg-like ions really are single lines, but multiplets of B through F sequence ions and Al through Cl ions are typically spread over 3 Å in the 500 Å region or over 0.3 Å in the 50 Å region. If this is important to you, see Doschek's line list.

- Your operating system may be unhappy at not having PHOT or APHOT, though it shouldn't care as long as IPHOT is zero. If necessary, make dummy subroutines PHOT(N,J,E,T,D) and APHOT(N,D,I).

- The power emitted by 1 cubic centimeter of gas at energies between $BINMIN + (I-1)*BINSYZ$ and $BINMIN + I*BINSYZ$ is

$$10^{-23} n_e n_H BIN(I) \text{ ergs s}^{-1}.$$

At wavelengths between $BLNMIN + (I-1)*BLNSYZ$ and $BLNMIN + I*BLNSYZ$ it is

$$10^{-23} n_e n_H BLN(I) \text{ ergs s}^{-1}.$$