Function GET_MW – single-thread version
built-in abundance tables

Calling syntax:

```
res = call_external(libname, 'GET_MW', Lparms, Rparms, Parms, $
                    T_arr, DEM_arr, DDM_arr, RL)
```

Function parameters:

0. Lparms – 5-element long integer array of dimensions and global (for all voxels) integer parameters (see below).
1. Rparms – 3-element double array of global (for all voxels) real parameters (see below).
2. Parms – array of LOS parameters, 15 × Nz elements, double. Parms[*, i] represents the parameters for *i*th voxel (see below).
3. T_arr – array of temperatures where DEM/DDM are specified, NT elements, double, in K. The temperature grid is assumed to be the same in all voxels, and the same for both DEM and DDM.
4. DEM_arr – array of DEMs, NT × Nz, double, in cm^{-6} K^{-1}. DEM_arr[*, i] represents the DEM for *i*th voxel.
5. DDM_arr – array of DDMs, NT × Nz, double, in cm^{-3} K^{-1}. DDM_arr[*, i] represents the DDM for *i*th voxel.
6. RL – input/output array, 7 × Nf, double. RL[*, i] corresponds to *i*th frequency (see below).

Array of dimensions and global integer parameters Lparms:
Lparms = [Nz, Nf, NT, DEM_key, DDM_key]

0. Nz – number of voxels along LOS;
1. Nf – number of frequencies in the spectrum;
2. NT – number of temperatures in the T_arr array; must be ≥ 2 – otherwise DEM/DEM are ignored;
3. DEM_key – global DEM on/off key.
   a. 0: DEM is enabled: it can be used in all or some voxels, depending on the local DEM on/off keys (see below).
   b. ≠ 0: DEM is disabled for all voxels, regardless of the local DEM on/off keys.
4. DDM_key – global DDM on/off key: same as above, but for DDM.

Array of global real parameters Rparms:
Rparms = [S, f_0, Δf]

0. S – visible source area, in cm^2.
1. f_0 – starting frequency of the spectrum, in Hz:
   a. is used, only if $f_0 > 0$;
   b. if $f_0 \le 0$, the frequencies are taken from the RL[0, *] array.
2. Δf – logarithmic frequency step (is used only if $f_0 > 0$).

Array of parameters Parms (for a single voxel, 15 parameters):

0. Parms[0] = Δz – voxel length, in cm.
1. Parms[1] = T_0 – plasma temperature, in K (is used if DEM or DDM are not specified).
2. Parms[2] = n_0 – either electron concentration or total atomic concentration (depending on other parameters), in cm^{-3} (is used if DEM or DDM are not specified).
3. Parms[3] = B – magnetic field strength, in G.
4. Parms[4] = θ – viewing angle, in degrees.
5. Parms[5] = φ – magnetic field azimuthal angle, in degrees.
6. Parms[6] – emission mechanism flag (rounded to the nearest integer):
    a. 0: all emission mechanisms (gyroresonance + free-free + contribution of neutrals) are included;
    b. 1: gyroresonance is off;
    c. 2: free-free is off;
    d. 4: contribution of neutrals is off.

    Several flags can be combined by usual or bitwise summation: e.g., mechanism flag = 2 + 4 turns off both free-free and contribution of neutrals, etc.
7. Parms[7] = s_{max} – maximum cyclotron harmonic number.
8. Parms[8] = n_p – proton concentration, in cm^{-3} (is used if DEM or DDM are not specified, and the temperature is low).
9. Parms[9] = n_{HI} – neutral hydrogen concentration, in cm^{-3}.
10. Parms[10] = n_{HeI} – neutral helium concentration, in cm^{-3}.
11. Parms[11] – local DEM on/off key:
    a. 0: DEM is used (provided that NT ≥ 2 and DEM is enabled by the global key);
    b. ≠ 0: DEM in this voxel is ignored even if it is specified; T_0 and n_0 are used instead.
12. Parms[12] – local DDM on/off key: same as above, but for DDM.
13. Parms[13] – element abundance model:
    a. 0: coronal (*default*);
    b. 1: photospheric (Caffau);
    c. 2: photospheric (Scott).
14. Parms[14] = Vox_ID – voxel type (coronal / chromospheric / etc.), currently ignored.

Input/output array RL:

0. First row (RL[0, *]) – emission frequencies, in GHz. On input, this array is used if f_0 = Rparms[1] ≤ 0; otherwise, the frequencies are computed using the f_0 and Δf parameters: $f_1 = f_0 10^{\Delta f}$, $f_2 = f_1 10^{\Delta f}$, etc. On output, this array contains the computed or pre-defined emission frequencies.

Other rows – emission intensities, as observed from the Earth, in sfu:

1. RL[1, *] – left polarization, weak mode coupling;
2. RL[2, *] – right polarization, weak mode coupling;
3. RL[3, *] – left polarization, strong mode coupling;
4. RL[4, *] – right polarization, strong mode coupling;
5. RL[5, *] – left polarization, exact mode coupling.
6. RL[6, *] – right polarization, exact mode coupling.

On input, these arrays specify the emission intensities at the start of the line-of-sight; on output, they contain the emission intensities at the end of the line-of-sight.

Return value: currently, -1 if the input was incorrect (incorrect number of parameters); 0 otherwise.

Function GET_MW – single-thread version
user-defined abundance tables

Calling syntax:

```
res = call_external(libname, 'GET_MW', Lparms, Rparms, Parms, $
                    T_arr, DEM_arr, DDM_arr, $
                    fzeta_arr, Tzeta_arr, zeta_arr, RL)
```

Function parameters:

0. Lparms – 8-element long integer array of dimensions and global (for all voxels) integer parameters (see below).

1-5. Rparms, Parms, T_arr, DEM_arr, DDM_arr – same as in the version with built-in abundance tables; for Parms, see a note below.

6. fzeta_arr – array of frequencies where the ζ-function is specified, Nf_zeta elements, double, in Hz. The frequency grid is assumed to be the same in all voxels and for all supplied abundance sets.

7. Tzeta_arr – array of temperatures where the ζ-function is specified, NT_zeta elements, double, in K. The temperature grid is assumed to be the same in all voxels and for all supplied abundance sets.

8. zeta_arr – array of ζ-function values, Nf_zeta × NT_zeta × N_zeta elements, double. This array is the same for all voxels. zeta_arr[*, *, m] represents the 2D ζ-function table for *m*th abundance set.

9. RL – same as in the version with built-in abundance tables.

Array of dimensions and global integer parameters Lparms:

Lparms = [Nz, Nf, NT, DEM_key, DDM_key, Nf_zeta, NT_zeta, N_zeta]

0-4. Nz, Nf, NT, DEM_key, DDM_key – same as in the version with built-in abundance tables.

5. Nf_zeta – number of frequencies where the ζ-function is specified.

6. NT_zeta – number of temperatures where the ζ-function is specified.

7. N_zeta – number of supplied 2D ζ-function tables (abundance sets).

Array of parameters Parms (for a single voxel):

Most of parameters are the same as in the version with built-in abundance tables, except Parms[13] that specifies the element abundance model index *m*, so that the 2D ζ-function table given by zeta_arr[*, *, m] is used in this voxel.

Return value: currently, -1 if the input was incorrect (incorrect number of parameters); 0 otherwise.

Function GET_MW_SLICE – multi-thread version
built-in abundance tables

Calling syntax:

```
res = call_external(libname, 'GET_MW_SLICE', Lparms_M, Rparms_M, $
                    Parms_M, T_arr, DEM_arr_M, DDM_arrM, RL_M)
```

Function parameters:

0. Lparms_M – 6-element long integer array of dimensions and global (for all voxels and all LOSs) integer parameters (see below).
1. Rparms_M – array of real parameters common for all voxels within each LOS, 3 × Npix, double (see below).
2. Parms_M – array of voxel parameters, 15 × Nz × Npix elements, double (see below).
3. T_arr – array of temperatures where DEM/DDM are specified, NT elements, double, in K. This parameter is the same as in the GET_MW function: the temperature grid is assumed to be the same in all voxels and all LOSs, and the same for both DEM and DDM.
4. DEM_arr_M – array of DEMs, NT × Nz × Npix, double, in cm^{-6} K^{-1} (see below).
5. DDM_arr_M – array of DDMs, NT × Nz × Npix, double, in cm^{-3} K^{-1} (see below).
6. RL_M – input/output array, 7 × Nf × Npix, double (see below).

Array of dimensions and global integer parameters Lparms_M:

Lparms_M = [Npix, Nz, Nf, NT, DEM_key, DDM_key]

0. Npix – number of LOSs.

Other elements (1^{st} to 5^{th}) are the same as the 0^{th} to 4^{th} elements of the Lparms array in the GET_MW function. In particular:

a. all LOSs have the same number of voxels Nz;
b. the number of frequencies Nf is the same for all LOSs;
c. the global DEM and DDM on/off keys are related to all voxels within all LOSs.

Other parameters: sub-arrays Rparms_M[*, i], Parms_M[*, *, i], DEM_arr_M[*, *, i], DDM_arr_M[*, *, i] and RL_M[*, *, i] correspond respectively to the parameters Rparms, Parms, DEM_arr, DDM_arr and RL of the single-thread GET_MW function, for ith LOS.

Return value: currently, -1 if the input was incorrect (incorrect number of parameters); 0 otherwise.

Function GET_MW_SLICE – multi-thread version for user-defined abundance tables: not implemented yet.