method: [FeI/H]=[FeII/H] (i.e., ionization equilibrium), independence between the metallicity and both the excitation potential (i.e., excitation equilibrium) and the equivalent widths. This method has been applied to solar type stars, for instance, in the determination of metallicity of stars with and without low mass companions or exoplanets (e.g., Gonzalez 1997, 1998; Gonzalez, Wallerstein, & Saar 1999; Santos, Israelian, & Mayor 2000; Gonzalez & Laws 2000; Gonzalez et al. 2001; Laws & Gonzalez 2001; Laws et al. 2003). The process estimate initially the fundamental parameters ($T_{\rm eff}$, $\log g$, [Fe/H] and ξ, the microturbulence velocity). This information is used in the ATLAS program (Kurucz 1993; Kurucz 1995, private communication) to derive a model atmosphere in LTE (local thermodynamic equilibrium). The model atmosphere with the measured equivalent widths of the spectra, is introduced in the code MOOG[4] to derive a new metallicity. If the mentioned conditions are not satisfied, the process is restarted using new fundamental parameters calculated with the downhill method.

In this contribution, we present the Fortran code FUNDPAR (and their complement `atlas.launcher`) that implements the method explained above. The programs are available from the Web[5], including detailed installation instructions and some technical details such as the format of the input/output files (`install.txt`). As an example of practical use, we derived the fundamental parameters of 58 main sequence exoplanet host stars and verified the metal-rich nature of the group. The values derived are in agreement with previous determinations from the literature.

In § 2 we show the general idea and the logic of the program. The procedure of minimization of the χ^2 function is detailed in § 3. The estimation of the uncertainties in the parameters and the comparison with literature, are showed in §§ 4 and 5, respectively. Finally we present some concluding remarks in § 6.

2. THE LOGIC OF THE PROGRAM

The algorithm is organized in one main procedure and a number of sub-programs with specific tasks. The iterative process begins at one starting point in a 4D-space, where the variables are ($T_{\rm eff}$, $\log g$, [Fe/H], ξ). This starting point could be optionally given in the first line of the input file (see the file `install.txt` for details of input/output files). If this point is unknown, the program adopts (5000 K, 4.00 dex, −0.10 dex, 1.00 km s^{-1}) to begin the iteration. For example, Santos et al. (2000) estimate $T_{\rm eff}$ and $\log g$ from the *uvby* photometry and the calibration of Olsen (1984), while [Fe/H] and ξ are estimated following Schuster & Nissen (1989) and Edvarsson et al. (1993), respectively.

Then for each iteration step, i.e., for each group of 4 parameters ($T_{\rm eff}$, $\log g$, [Fe/H], ξ), the program should:

(a) Generate an appropriate ATLAS model atmosphere (through the `atlas.launcher` program). First, the code should select from the Kurucz grid the model atmosphere closest in the parameter space to those requested and take this as initial input model. Then the program executes ATLAS9 to derive the final model.

(b) Transform the model atmosphere to a format readable by MOOG (subroutine `kurucz2moog`). The format of the model atmosphere used by MOOG is not exactly the Kurucz model and should be rewritten accordingly.

(c) Call the MOOG program. At this point, the program takes the file containing the equivalent widths of the FeI and FeII lines of the star and the model atmosphere as input for the MOOG program. The MOOG program is executed using a driver called "abfind" which is selected for the abundance determination.

(d) Read the new metallicity values calculated by MOOG (subroutine `rmr, read-moog-results`); and finally,

(e) Determine the value of the χ^2 function. This step will be explained below.

We take into account the conditions mentioned in the introduction through a variable called χ^2. We adopt for χ^2 the expression $\chi^2 = w_1c_1^2+w_2c_2^2+w_3c_3^2+w_4c_4^2$, where w_1,...,w_4 are weight factors ($w_i \geq 0$), c_1 and c_2 are the slopes in the plots of [Fe/H] vs. $\log_{10}({\rm W}/\lambda)$ (logarithm of the reduced equivalent width) and [Fe/H] vs. excitation potential, c_3 = [FeI/H] − [FeII/H], and c_4 is the difference between the input ATLAS metallicity (Step a) and the resulting metallicity using equivalent widths (Step d). We added explicity the fourth condition: the input metallicity of the model atmosphere should be similar to the output metallicity derived from equivalent widths, i.e., the term with c_4. Then, the four conditions are quantified in the χ^2 function: the solution corresponds to the minimum value of χ^2.

[4] http://verdi.as.utexas.edu/moog.html.
[5] http://icate-conicet.gob.ar/saffe/fundpar/.