Determination of Stellar Parameters of the TIGRE Telescope Sample

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November 9^{th} 2019

Outline

Introduction

"A star is a gaseous sphere in which the inward pull of gravity is balanced by the expanding tendency due to the internal gas pressure gradient". De Boer, K. (2012)

We can know important information about the inward of a star by the study of their atmosphere.

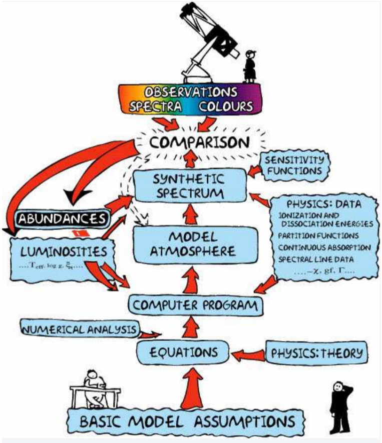
The knowledge of the structure of stellar atmospheres comes from the nature of the radiation that is detected.

The Most Important Atmospheric Parameters in a Star

By studying the atmosphere of a star we can obtain important information of its interior, since it is the transition zone from the interior of star to the IM.

- Effecive Temperature T_{eff}
- Surface Gravity **g**
- Chemical Composition, given by the abundance of the elements **XYZ**
- Mass
- Age

Modelling Atmospheres



The model of the atmosphere can be used to calculate the details about the emitted spectral distribution.
The observed spectrum contains information about the atmosphere and the properties of the star.

Observations with TIGRE Telescope

During the period of September 2017 to April 2018, the TIGRE telescope has been observed a sample of 134 stars with the following criteria:

- S&N approximately 40 to 50
- The parallax is reported in GAIA
- The radial velocity has not been reported in SIMBAD
- The B-V color index is greater than 0.3

Observations with TIGRE Telescope

According to the stablish criteria, the final sample was of 134 stars. From this sample, 30 of this stars were observed during the period from September 2018 to April of 2018.

Our aim is from the study of the sample of these 30 stars, we want to obtain the physical and atmospheric parameters and classify them in the Hertzprung-Russell Diagram of Spectral classification with evolution tracks codes.

Determining Stellar Parameters Method

The physical parameters of this sample of 30 stars will be obtained from the program **iSpec.**

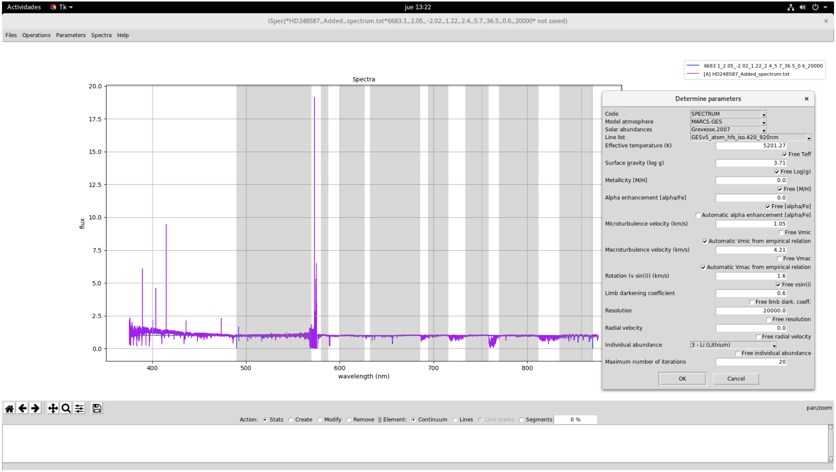
iSpec is a tool for the treatment and analysis of stellar spectra, since is able to determine atmospheric parameters.
(Blanco-Cuaresma, S., Soubiran, C., Jofr, P., & Heiter, U. (2013).)

Synthetic spectral fitting technique

iSpec has two techniques to derive atmospheric parameters:

- The synthetic spectral fitting technique
- The equivalent width method

We use the synthetic spectral fitting which minimizes χ^2 between an observed spectrum and synthetic spectra which is synthesized or interpolated from precalculated grids.


Actividades
Tk
jue 13:22
iSpec(*HD248587_Added_spectrum.txt*6683.1_2.05_-2.02_1.22_2.4_5.7_36.5_0.6_20000* not saved)
Files Operations Parameters Spectra Help
6683.1_2.05_-2.02_1.22_2.4_5.7_36.5_0.6_20000
[A] HD248587_Added_spectrum.txt
Spectra
flux
wavelength (nm)
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
400
500
600
700
800
Determine parameters
Code SPECTRUM
Model atmosphere MARCS.GES
Solar abundances Grevesse.2007
Line list GESv5_atom_hfs_iso.420_920nm
Effective temperature (K) 5201.27
Free Teff
Surface gravity (log g) 3.71
Free Log(g)
Metallicity [M/H] 0.0
Free [M/H]
Alpha enhancement [alpha/Fe] 0.0
Free [alpha/Fe]
Automatic alpha enhancement [alpha/Fe]
Microturbulence velocity (km/s) 1.05
Free Vmic
Automatic Vmic from empirical relation
Macroturbulence velocity (km/s) 4.21
Free Vmac
Automatic Vmac from empirical relation
Rotation (v sin(i)) (km/s) 1.6
Free vsin(i)
Limb darkening coefficient 0.6
Free limb dark. coeff.
Resolution 20000.0
Free resolution
Radial velocity 0.0
Free radial velocity
Individual abundance 3 - Li (Lithium)
Free individual abundance
Maximum number of iterations 20
OK
Cancel
pan/zoom
Action: Stats Create Modify Remove || Element: Continuum Lines Line marks Segments 0 %

First Results

Star	Teff_initial	log g_initial		teff	logg	MH	alpha	vmic	vmac	vsini	limb	R	X^2
HD38288	4861.105	3.684		5112.37	3.5	0.09	−0.16	1.05	3.37	8.13	0.6	20000	41463.87
			Error	12.38	0.03	0.01	0.01	0	0	0.13	0	0	
HD38365	4789.5	3		4924.04	3.14	0.69	−0.21	1.28	2.85	12.44	0.6	20000	3721.7117
			Error	40.15	0.15	0.03	0.05	0	0	0.62	0	0	
HD38377	6277.875	3.7		6520.27	4.45	0.23	−0.22	1.41	8.98	38.03	0.6	20000	17065.657
			Error	19.17	0.03	0.01	0.01	0	0	0.33	0	0	
HD38543	4762.1865	3.6		4996.78	3.41	0.34	−0.18	1.23	3.19	7.83	0.6	20000	54213.607
			Error	6.54	0.01	0.01	0.01	0	0	0.12	0	0	
HD38632	5366	3.72		5436.21	3.5	0.76	−0.07	1.34	2.66	15.99	0.6	20000	21452.031
			Error	29.81	0.03	0.02	0.03	0	0	0.39	0	0	
HD38753	6866.6665	3.8		6784.46	4.44	−0.02	−0.1	1.56	12.01	142.5	0.6	20000	8366.588
			Error	25.44	0.05	0.02	0.03	0	0	1.97	0	0	
HD38960	5385.75	3.72		6629.03	2	−0.36	0.12	4.26	4.79	73.71	0.6	20000	54077.586
			Error	5.96	0.01	0.01	0.01	0.11	0	0.59	0	0	

First Results

HD39030	4773.0664	3.67		5028.67	3.5	0.27	−0.16	1.05	3.24	9.12	0.6	20000	23572.441
			Error	14.57	0.03	0.01	0.01	0	0	0.16	0	0	
HD39167	4908.63	3.687		5213.37	3.48	0.2	−0.13	1.24	3.37	7.24	0.6	20000	33235.698
			Error	7.51	0.01	0.01	0.01	0	0	0.13	0	0	
HD39168	5214.3335	3.72		5399.76	3.58	0.39	−0.17	1.11	3.05	9.44	0.6	20000	37254.868
			Error	10.26	0.02	0.01	0.01	0	0	0.1	0	0	
HD39305	4821.295	3.674		5023.19	2.97	0.35	−0.2	1.29	3.41	7.19	0.6	20000	77943.771
			Error	6.93	0.02	0.01	0.01	0	0	0.09	0	0	
HD39392	6011	3.776		6567.24	4.26	0.12	−0.01	1.46	9.58	0	0.6	20000	3286.5177
			Error	35.86	0.07	0.02	0.04	0	0	0	0	0	
HD39393	4949.907	3.67		5404.65	2.85	0.38	−0.21	1.39	3.49	13.09	0.6	20000	41044.699
			Error	7.62	0.02	0.01	0.01	0	0	0.1	0	0	
HD39454	4203.76	3.6225		4415.39	1.45	0.18	0.06	1.51	4.54	7.72	0.6	20000	64397.604
			Error	5.63	0.02	0.01	0.01	0	0	0.1	0	0	

First Results

HD39631	5053.8633	3.7		5190.44	2.99	0.29	−0.21	1.31	3.5	6.15	0.6	20000	54930.063
			Error	7.94	0.02	0.01	0.01	0	0	0.11	0	0	
HD39727	6349.9336	3.802		6607.23	4.75	0.23	−0.12	1.42	9.85	4.73	0.6	20000	4245.0739
			Error	33.54	0.06	0.02	0.02	0	0	1.05	0	0	
HD39879	4164.895	3.62		4441.49	1.46	0.09	−0.03	1.5	4.64	7.22	0.6	20000	61096.898
			Error	6.74	0.02	0.01	0.01	0	0	0.1	0	0	
HD39897	4674.06	3.665		4755.66	2.48	0.43	0.04	1.35	3.53	9.05	0.6	20000	69306.512
			Error	7.81	0.02	0.01	0.01	0	0	0.09	0	0	
HD40772	4050.8733	3.61		4259.12	1.55	0.15	0.05	1.55	4.42	9.37	0.6	20000	25755.784
			Error	11.53	0.03	0.02	0.01	0	0	0.15	0	0	
HD40911	4242.1934	3.626		4349.15	1.97	0.09	0	1.47	4.18	6.26	0.6	20000	24483.958
			Error	8.45	0.04	0.01	0.01	0	0	0.17	0	0	
HD40961	5024.9136	3.7		5234.45	3.47	0.2	−0.12	1.25	3.39	6.1	0.6	20000	37720.659
			Error	7.11	0.01	0.01	0.01	0	0	0.14	0	0	

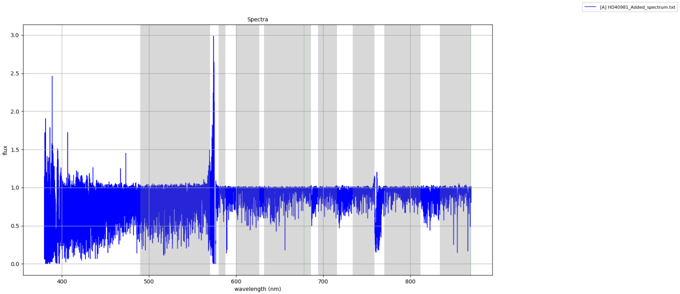
First Results

HD40981	5004.2026	3.699		5214.46	2.98	0.22	−0.12	1.31	3.59	6.25	0.6	20000	15672.034
			Error	14.33	0.03	0.01	0.01	0	0	0.18	0	0	
HD41239	6640.3	3.822		6999.98	4.38	0.16	0.01	1.72	14.42	29.08	0.6	20000	13823.086
			Error	13.77	0.02	0.01	0.01	0	0	0.36	0	0	
HD41469	4855.2334	3.68		5125.95	2.99	0.12	−0.09	1.29	3.7	6.26	0.6	20000	44076.728
			Error	9.51	0.02	0.01	0.01	0	0	0.13	0	0	
HD41601	4157.525	3.61		4408.74	1.23	0.14	−0.03	1.54	4.79	8.03	0.6	20000	34974.008
			Error	5.94	0.05	0.01	0.01	0	0	0.14	0	0	
HD248178	4484.1396	3.64		4565.8	1.49	−0.28	−0.06	1.45	5.06	5.34	0.6	20000	73563.55
			Error	5.4	0.01	0.01	0.01	0	0	0.1	0	0	
HD248587	5201.27	3.71		6698.24	2.31	−1.37	0.75	2.35	5.29	43.17	0.6	20000	22721.353
			Error	11.15	0.03	0.03	0.04	0	0	1.03	0	0	
HD249092	5029.8604	3.7		5102.21	2.98	0.33	−0.11	1.3	3.45	6.72	0.6	20000	50468.306
			Error	8.08	0.02	0.01	0.01	0	0	0.11	0	0	
HD250351	4855	3.68		4913.27	2.48	−0.27	0.02	1.31	4.37	4.12	0.6	20000	30313.446
			Error	8.81	0.02	0.01	0.01	0	0	0.16	0	0	

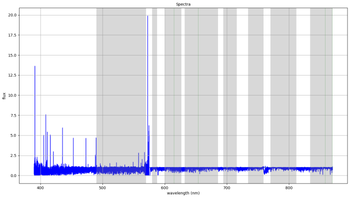
First Results

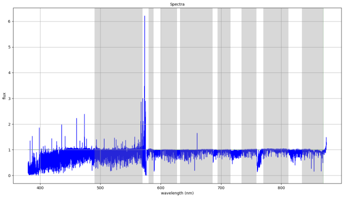
Also, three binary systems were found

- **HD40981**



First Results





Discussion

- We have to determine a good fit for the continuum
- Also, for lower quantities in the metallicity, we have to check the lines in the spectrum.
- Don't trust in SIMBAD!
- The next step in this work is use the evolution track codes to classify the stars in the HR Diagram.

References

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