

The recent discovery of two extremely metal-poor dwarf stars in the Galactic halo

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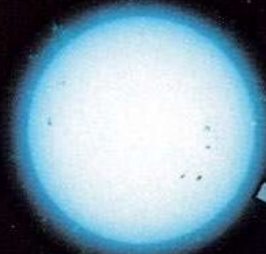
Kavli IPMU
Tokyo 20181203



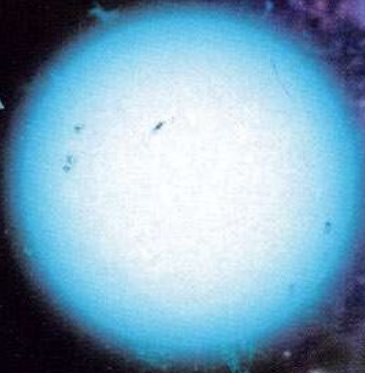
Introduction: The Early Universe

The first stars and their descendants

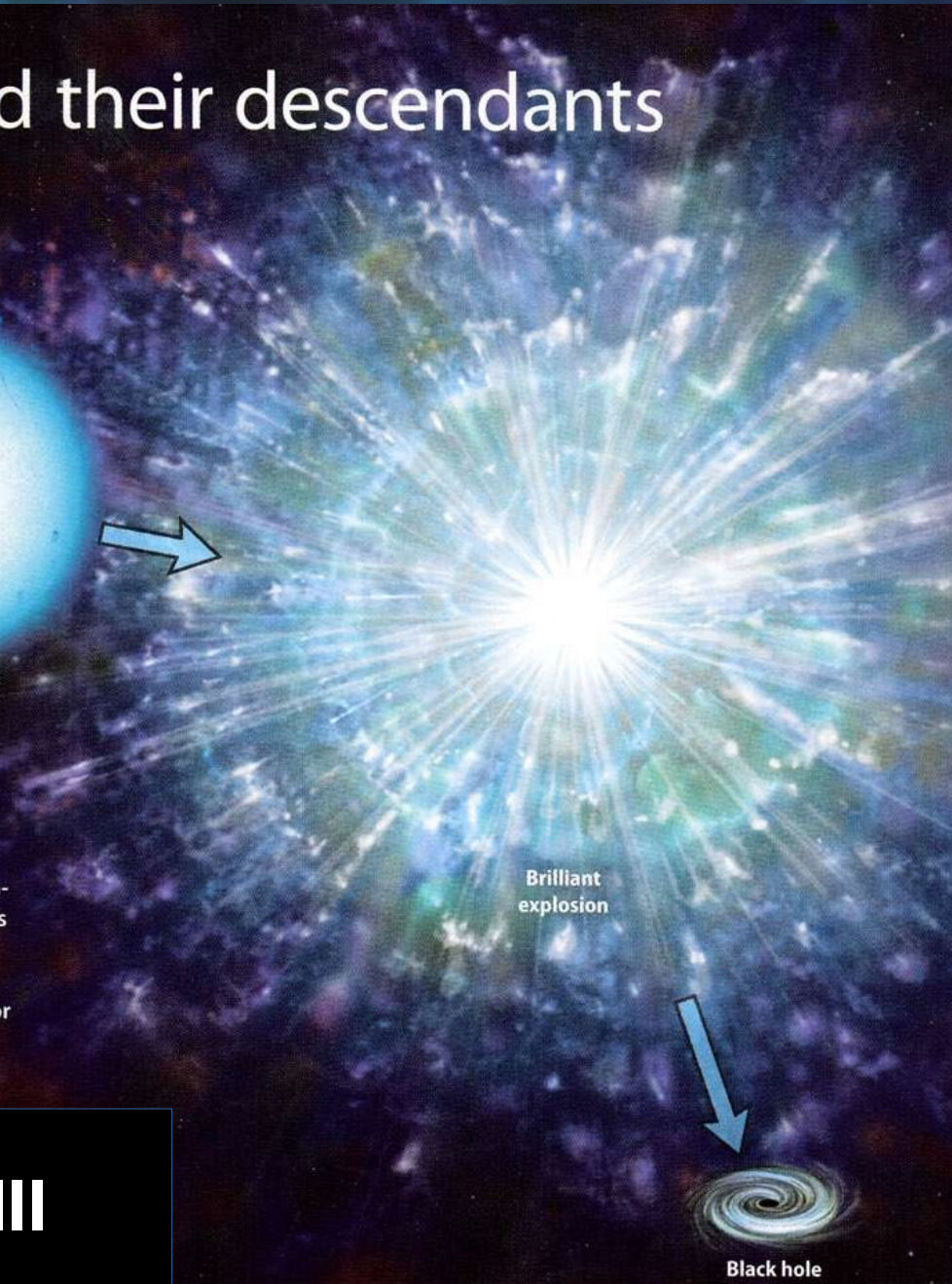
First star



Massive blue star
(100 solar masses)



Blue giant



Brilliant
explosion



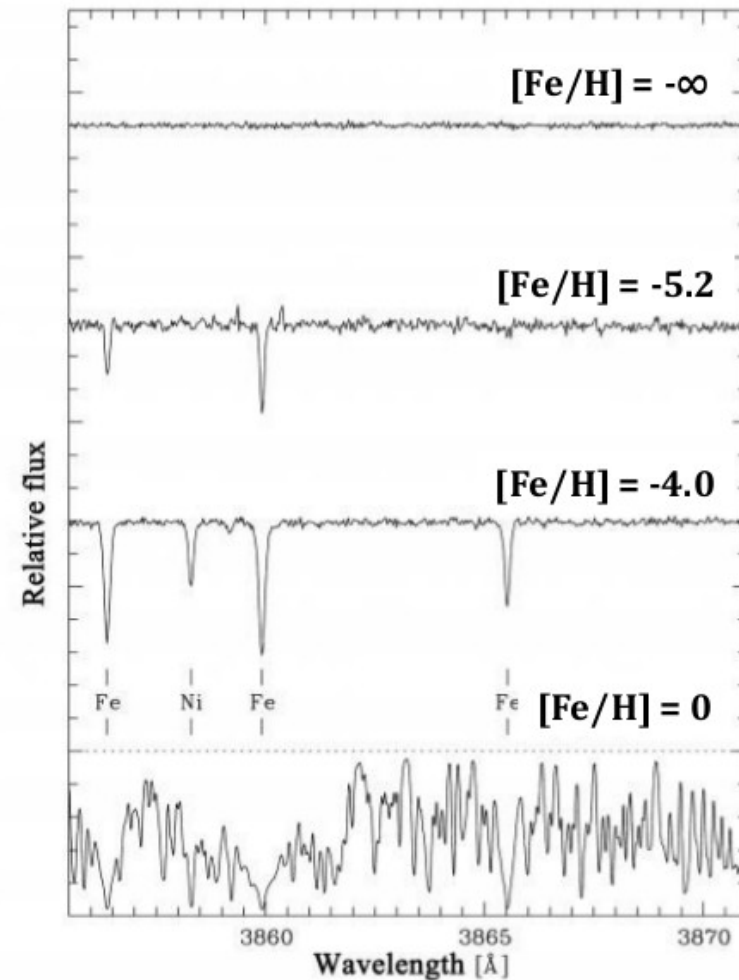
Black hole

ONE OF THE FIRST STARS would have been extremely massive — 100 solar masses in this example — formed mostly from hydrogen, helium, and a tiny amount of lithium gas. After just a few million years, the star burned its fuel and ended in fantastic style: as a huge explosion. The star's material — including heavy elements — was ejected. Either its core collapsed as the first black hole, or the explosion was powerful enough to blow up completely and scatter the star's material throughout space.

POPULATION III

Introduction: The Early Universe

Metal-poor stars



4MOST
collaboration

1-Methodology to find Metal-Poor Stars

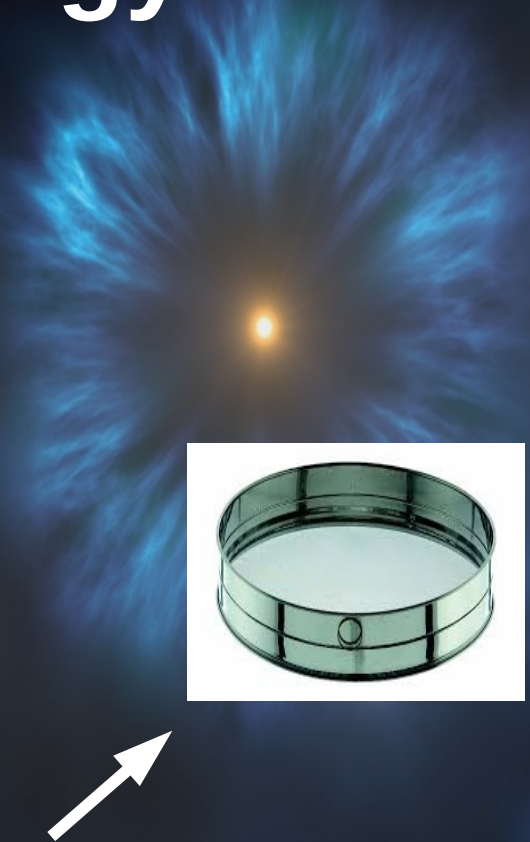


1-Methodology to find Metal-Poor Stars



~10,000,000 spectra from SDSS and LAMOST or PRISTINE and J-plus

1-Methodology to find Metal-Poor Stars

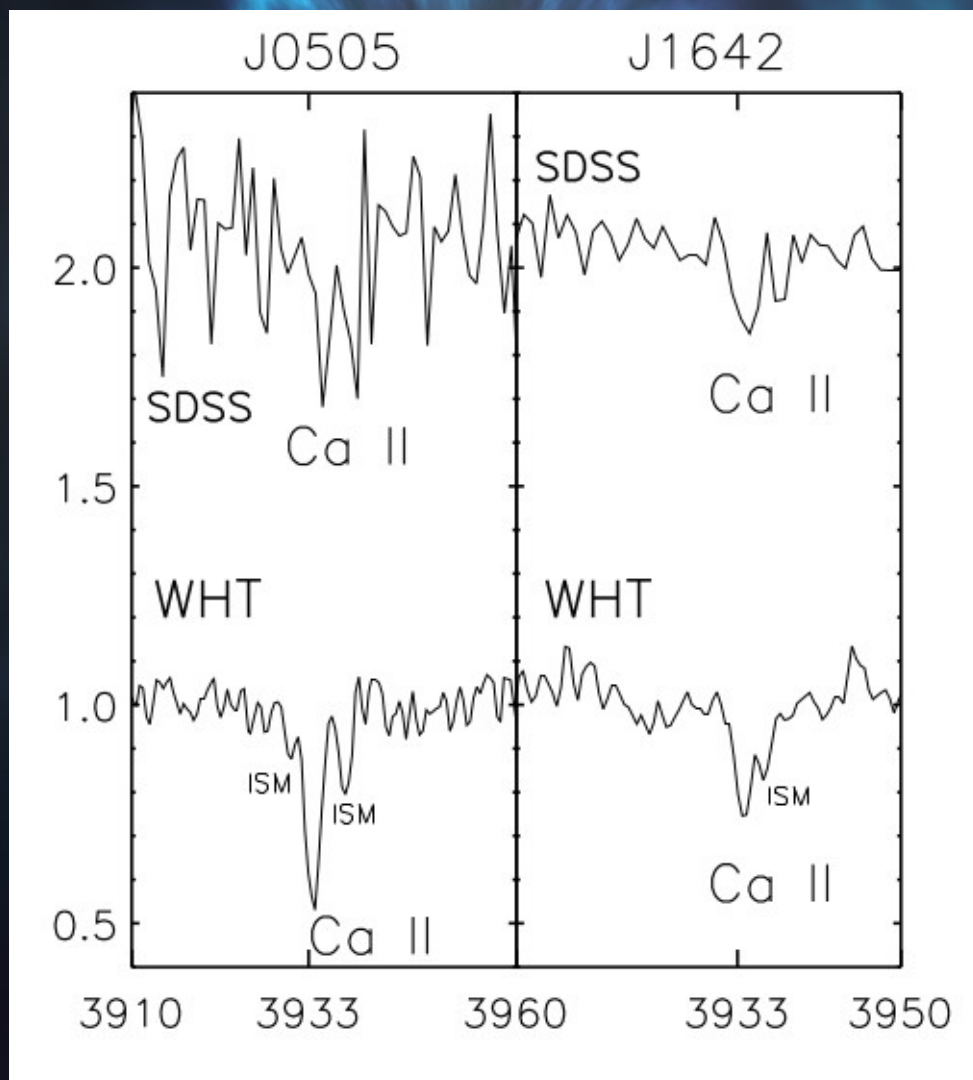


~500 candidates to observe with ISIS at WHT or with OSIRIS at GTC



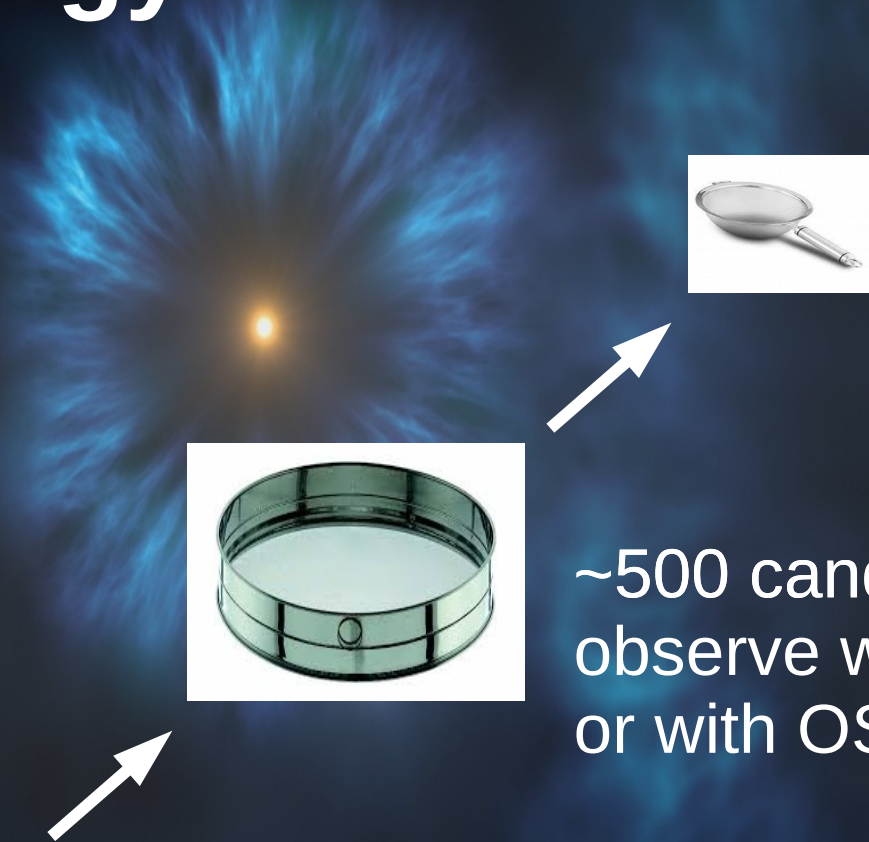
~3,000,000 spectra from SDSS and LAMOST

1-Methodology to find Metal-Poor Stars



Aguado+ 2016

1-Methodology to find Metal-Poor Stars



6 UMP stars

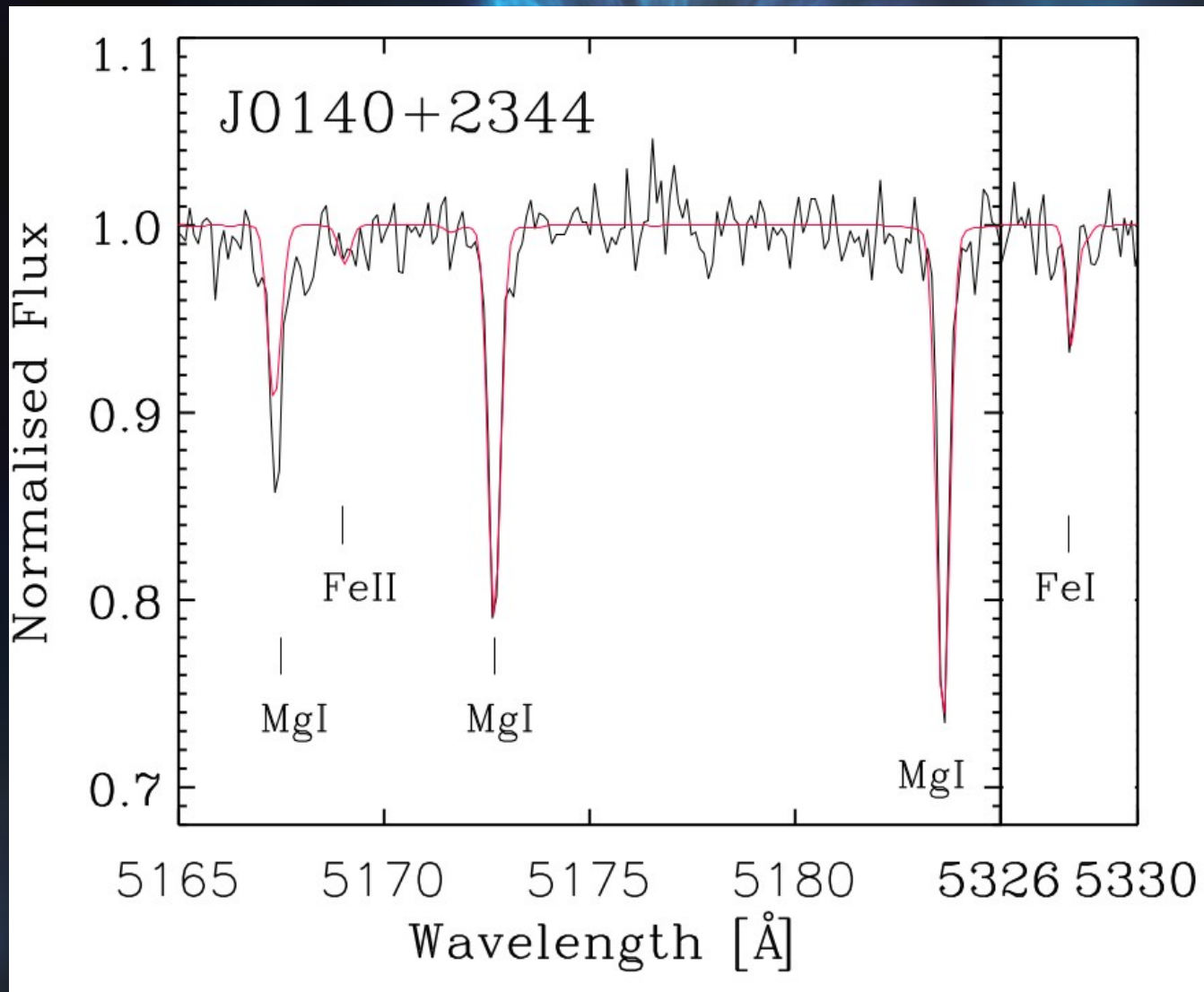


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1-Methodology to find Metal-Poor Stars

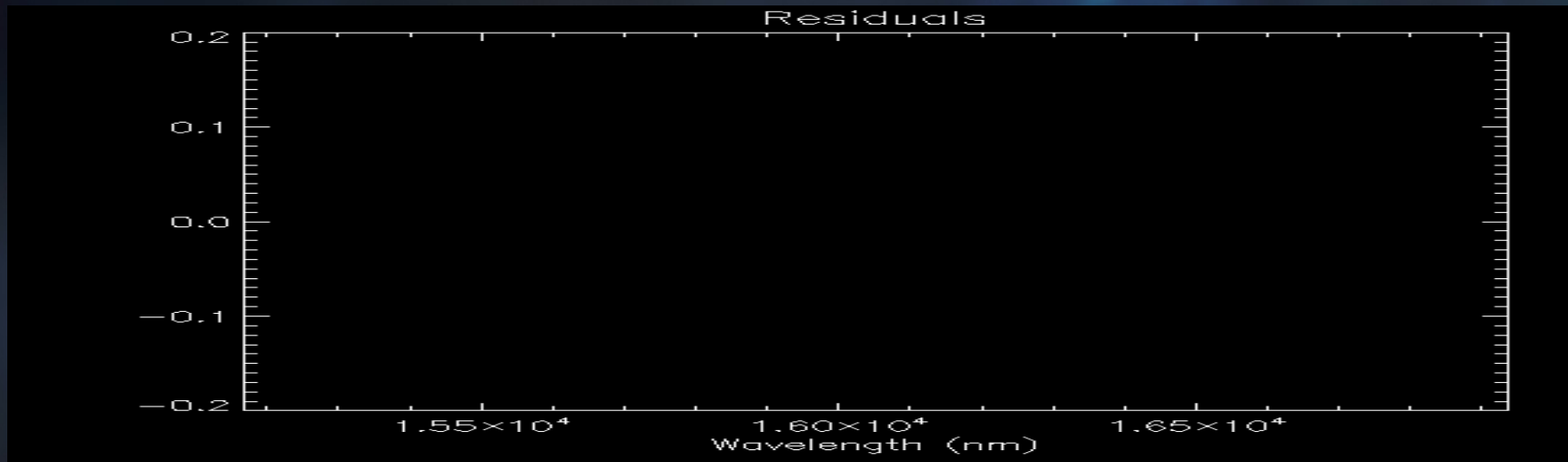
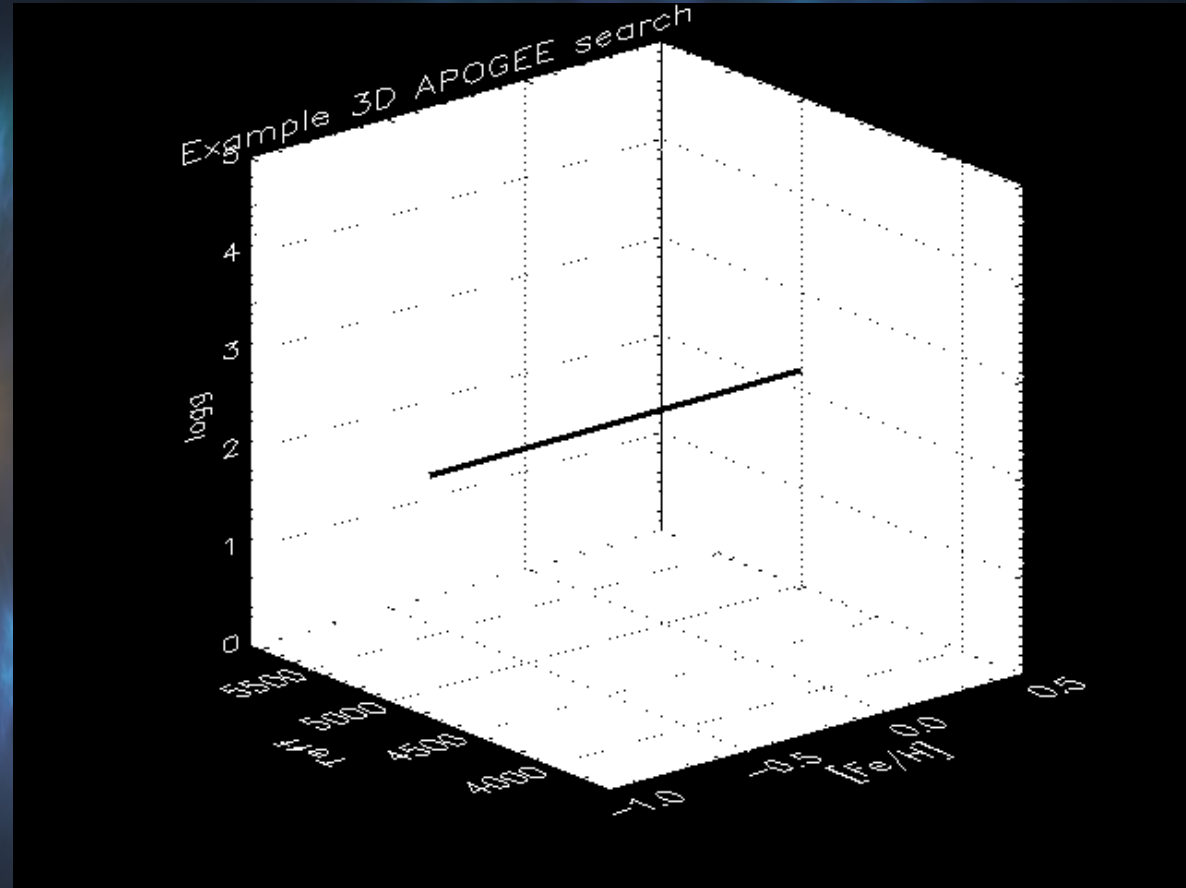


Aguado+ 2016

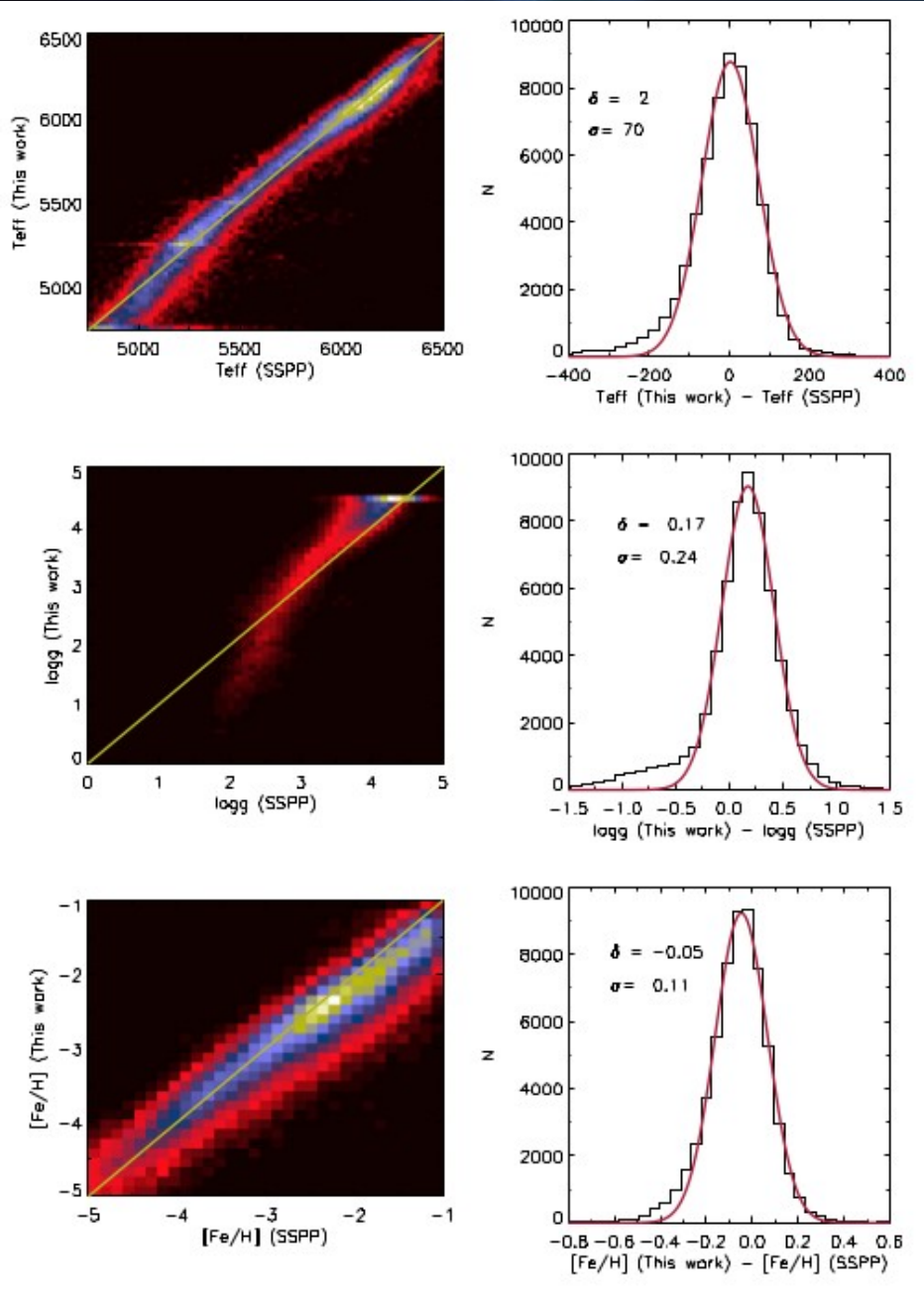
2-Spectroscopic analysis with FERRE

- FERRE is a FORTRAN code developed by Allende Prieto (Allende+ 2014)
- FERRE is able to compare data with a grid of theoretical models
- FERRE searches for the best solution on the N space parameters
- FERRE interpolates between the nodes of the grid

2-Spectroscopic analysis with FERRE

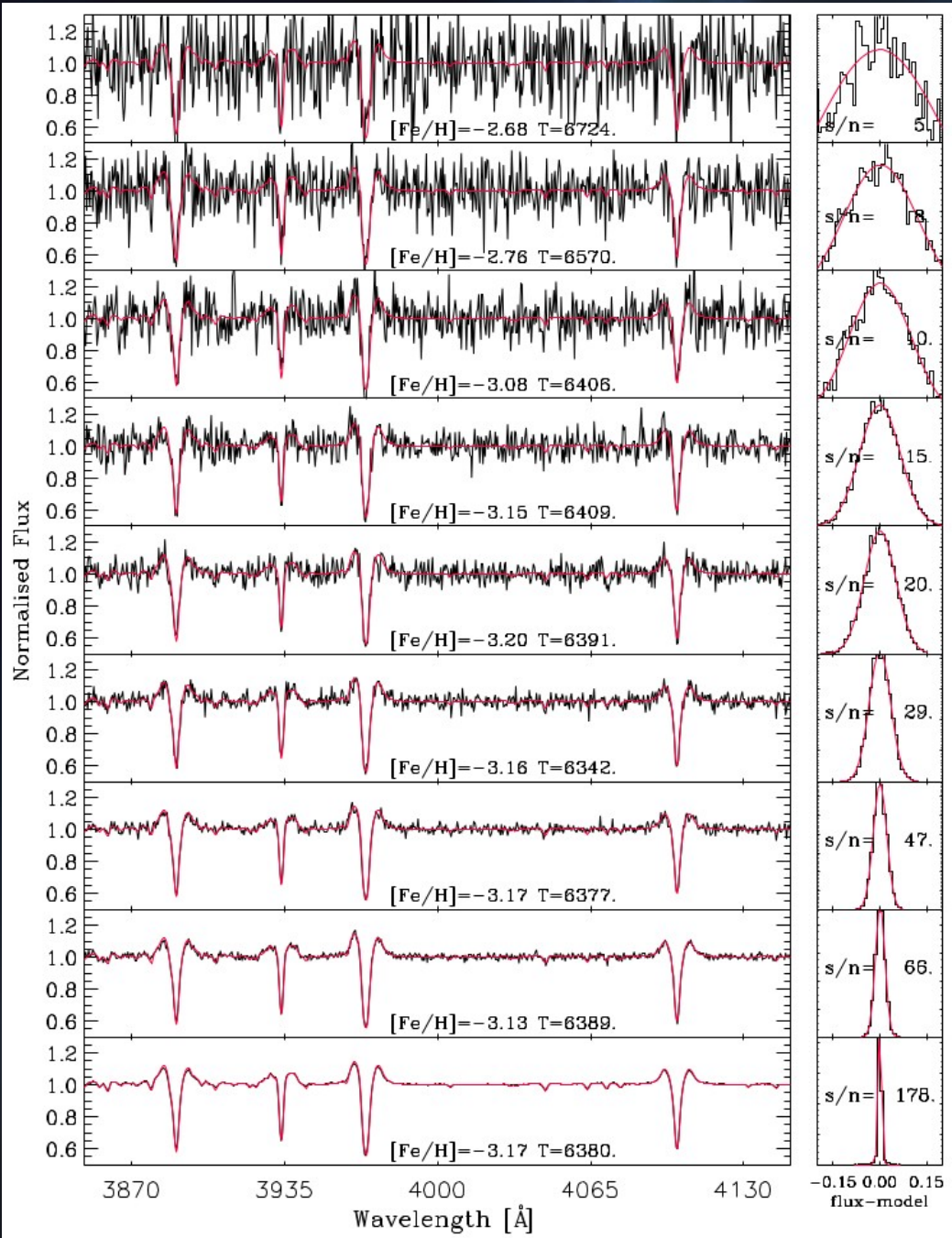


2-Spectroscopic analysis with FERRE



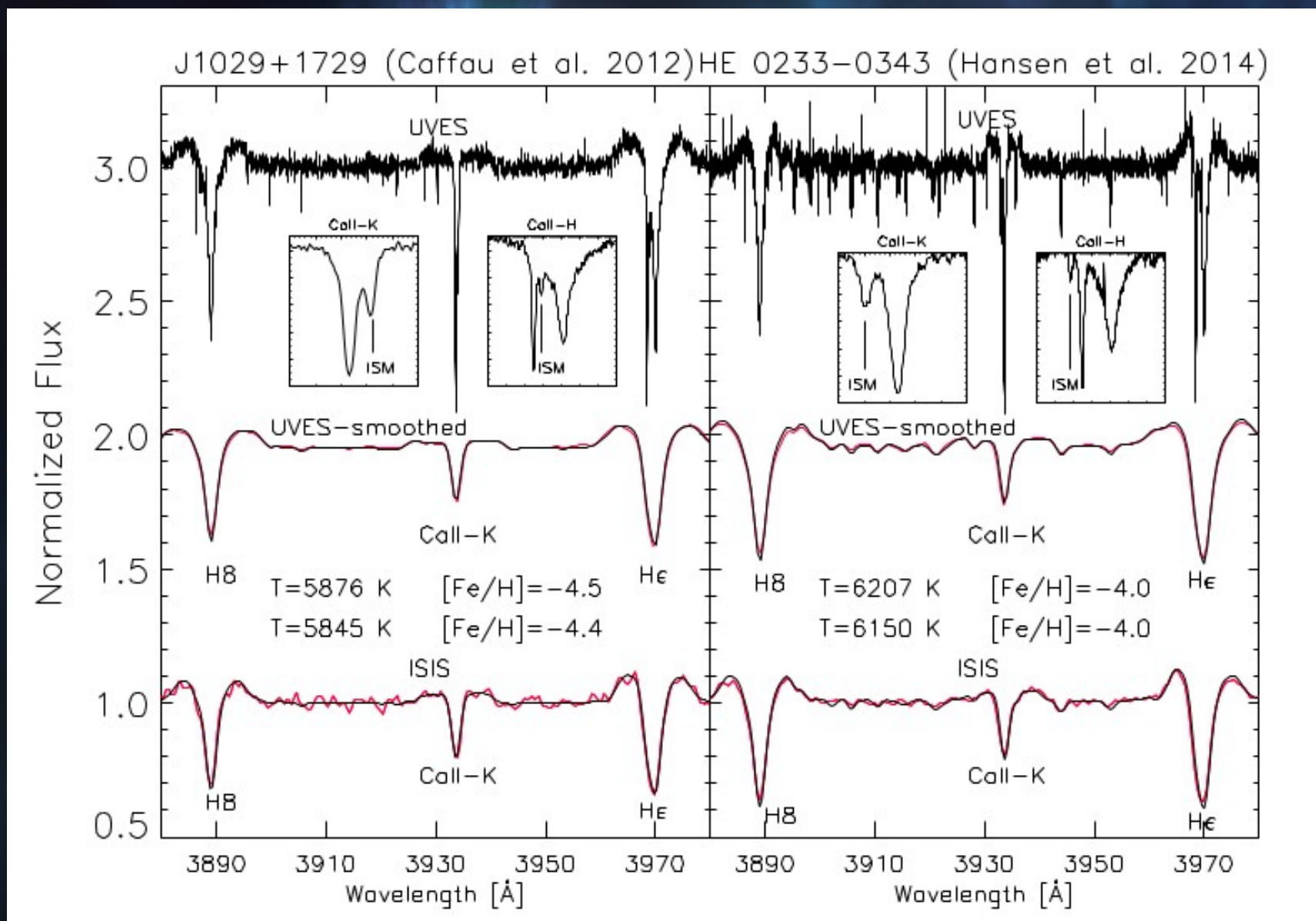
Allende Prieto+ (2014)

2-Spectroscopic analysis with FERRE



Aguado+ (2017a)

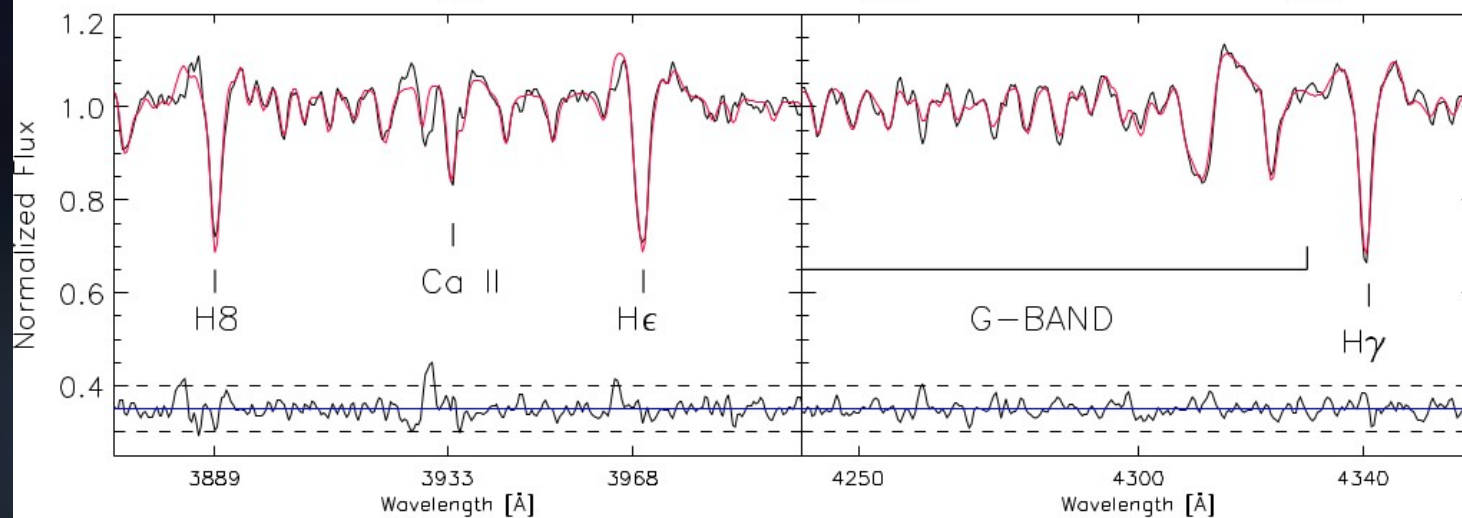
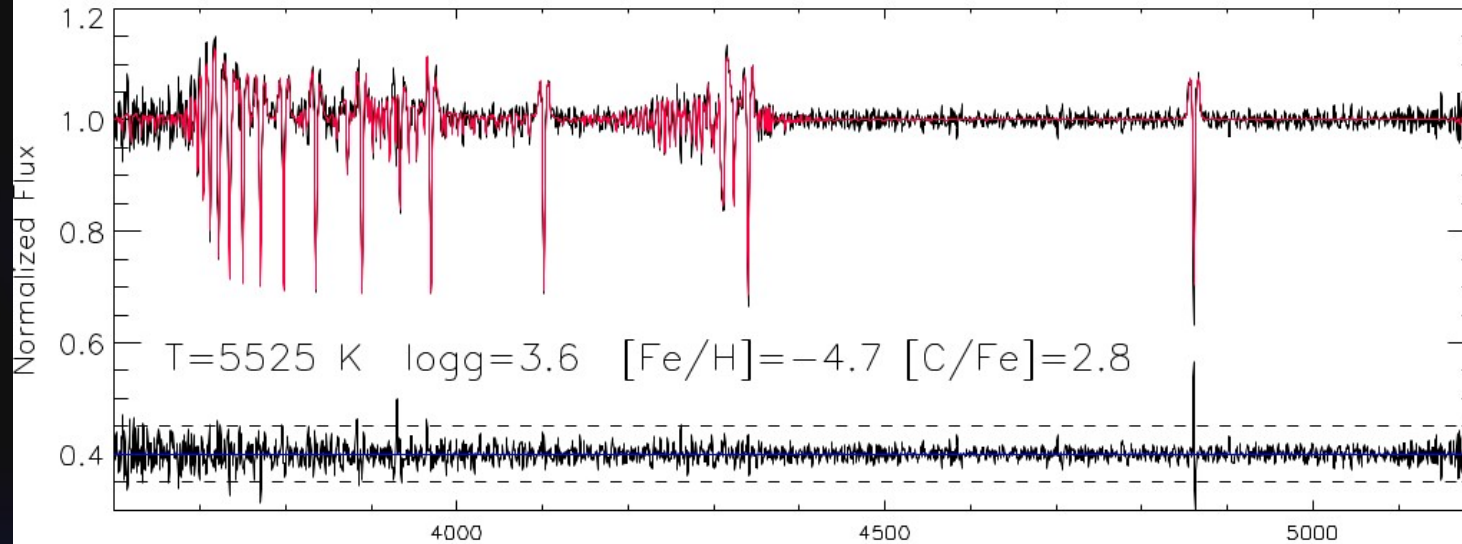
2-Spectroscopic analysis with FERRE



Aguado+ (2017a)

2-Spectroscopic analysis with FERRE

SDSS J1313-0019



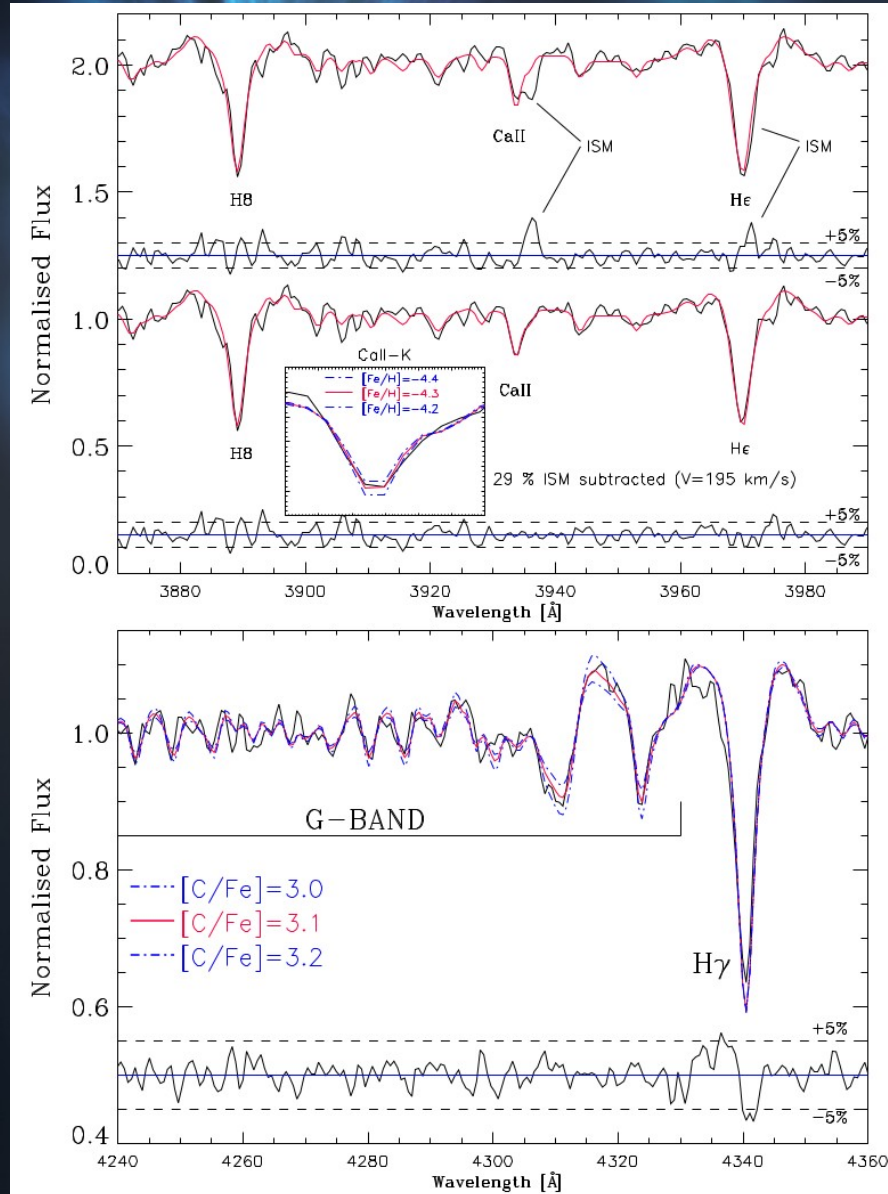
Allende
Prieto+
(2015)

Frebel+
(2015)

Aguado+
(2017a)

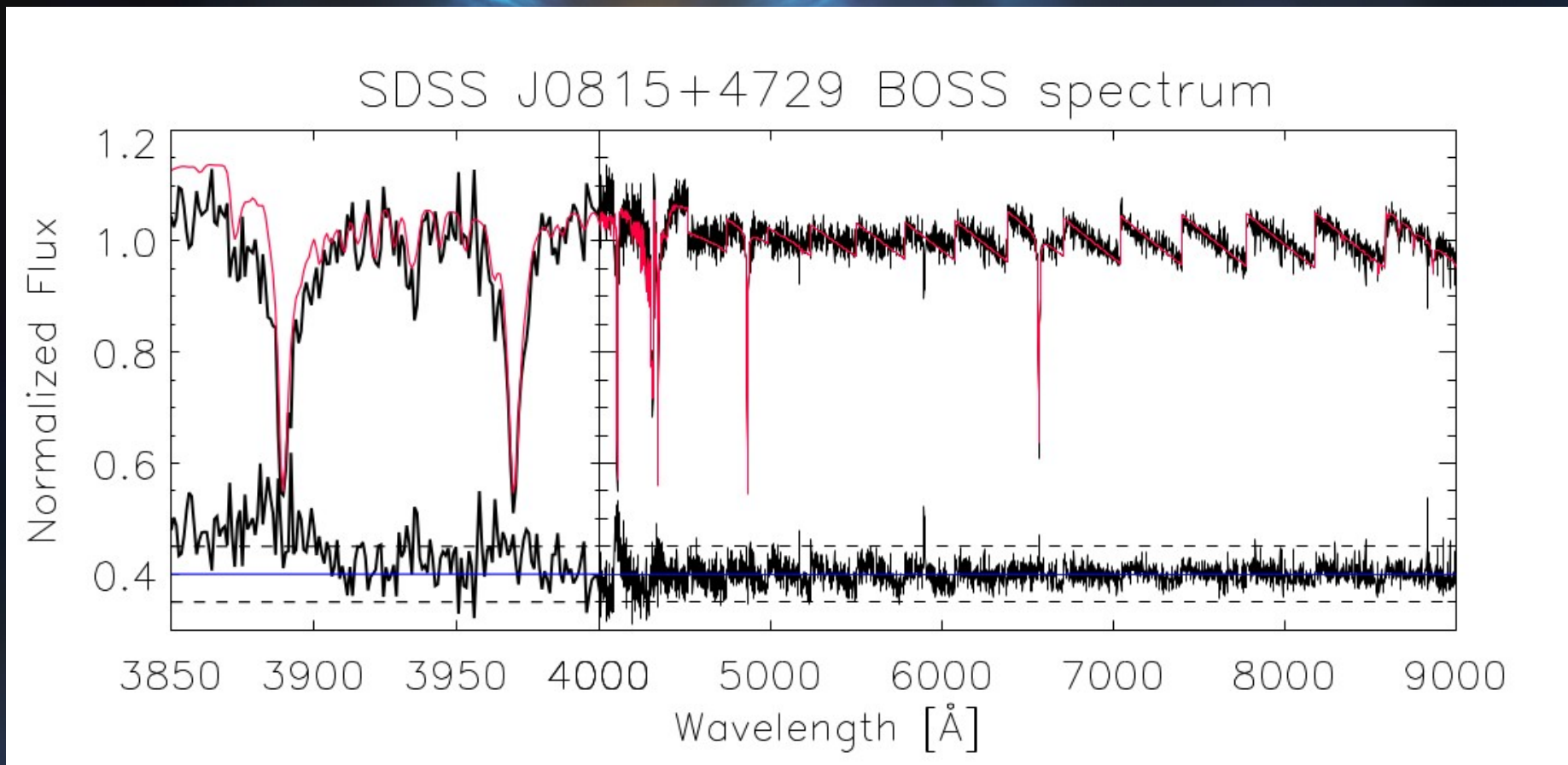
2-Spectroscopic analysis with FERRE

Aguado+ (2017b)



3-The Discovery of J0815+4729

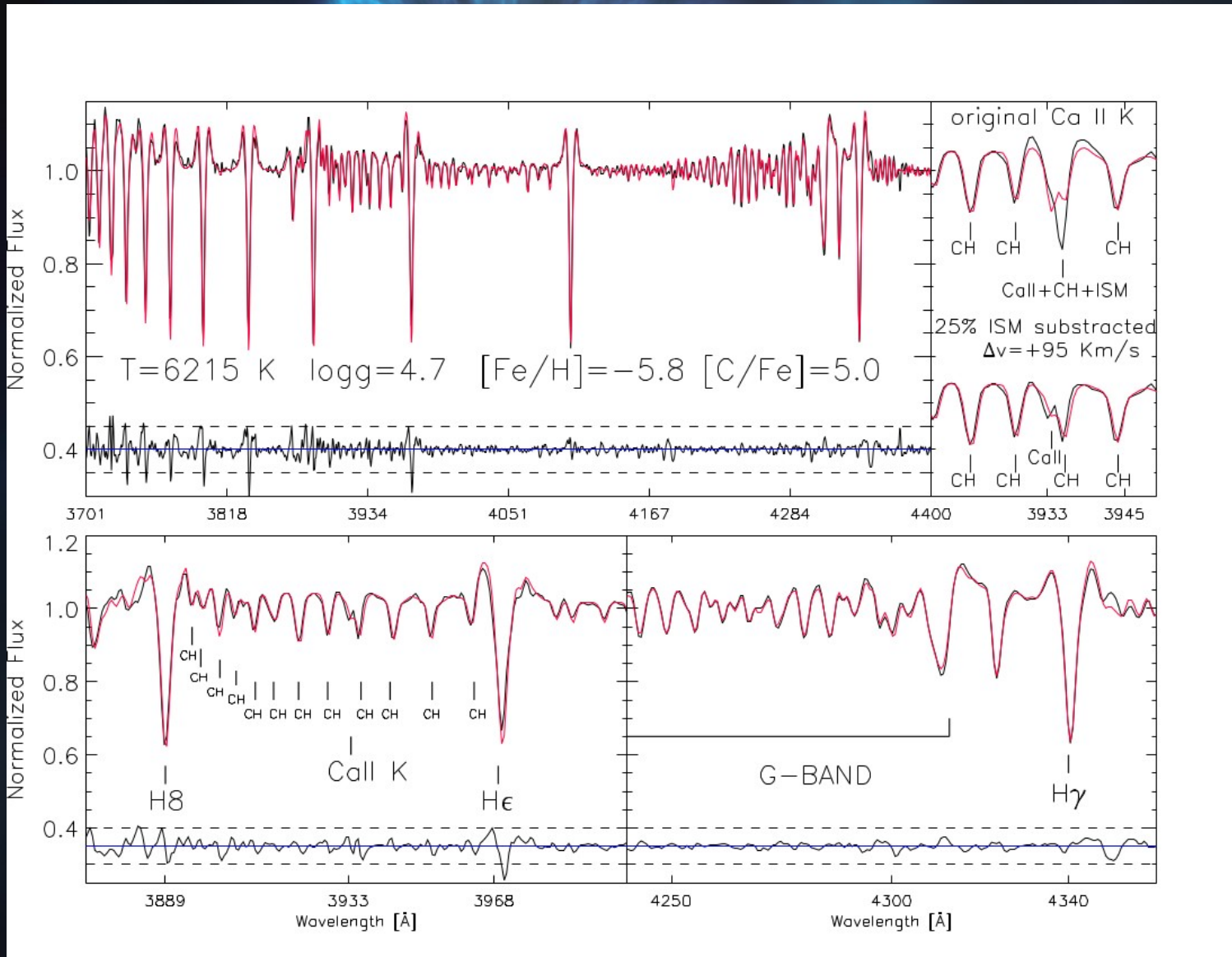
Aguado+ (2018a)



3-The Discovery of J0815+4729

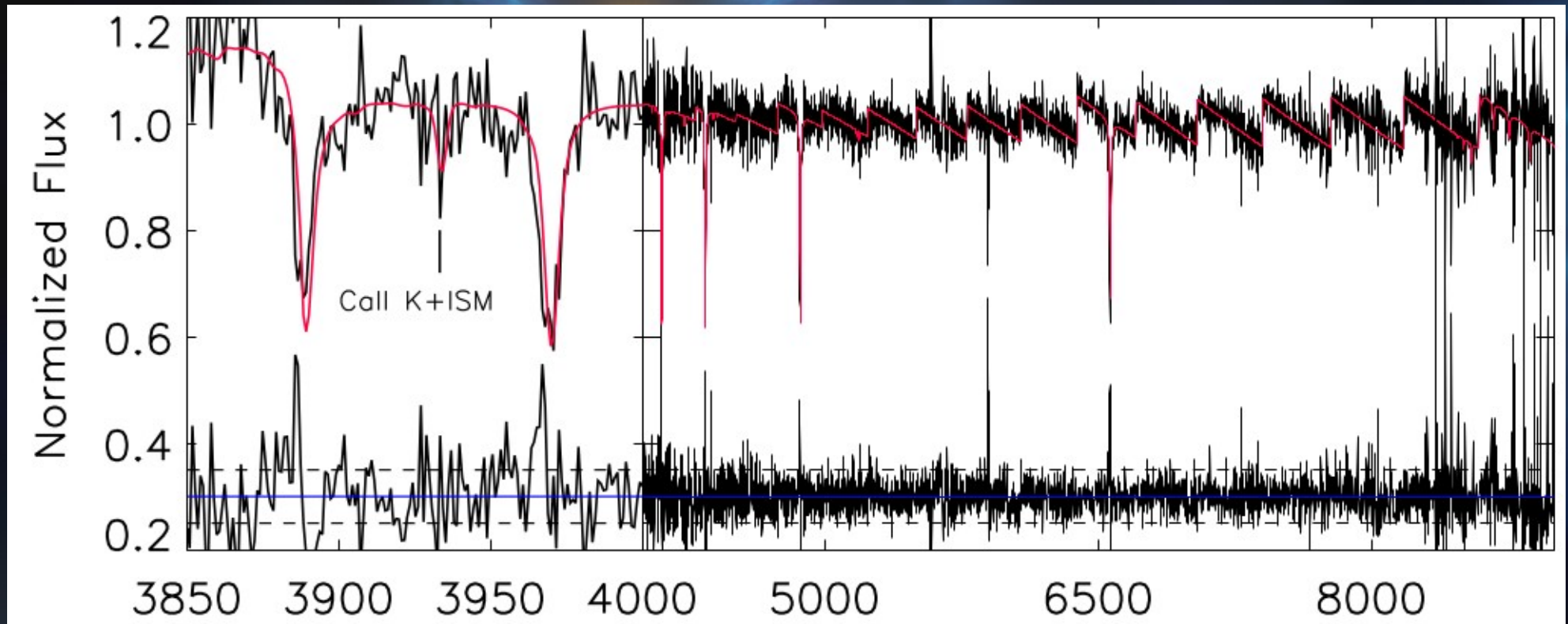
Aguado+ (2018a)

極超金屬欠乏星！



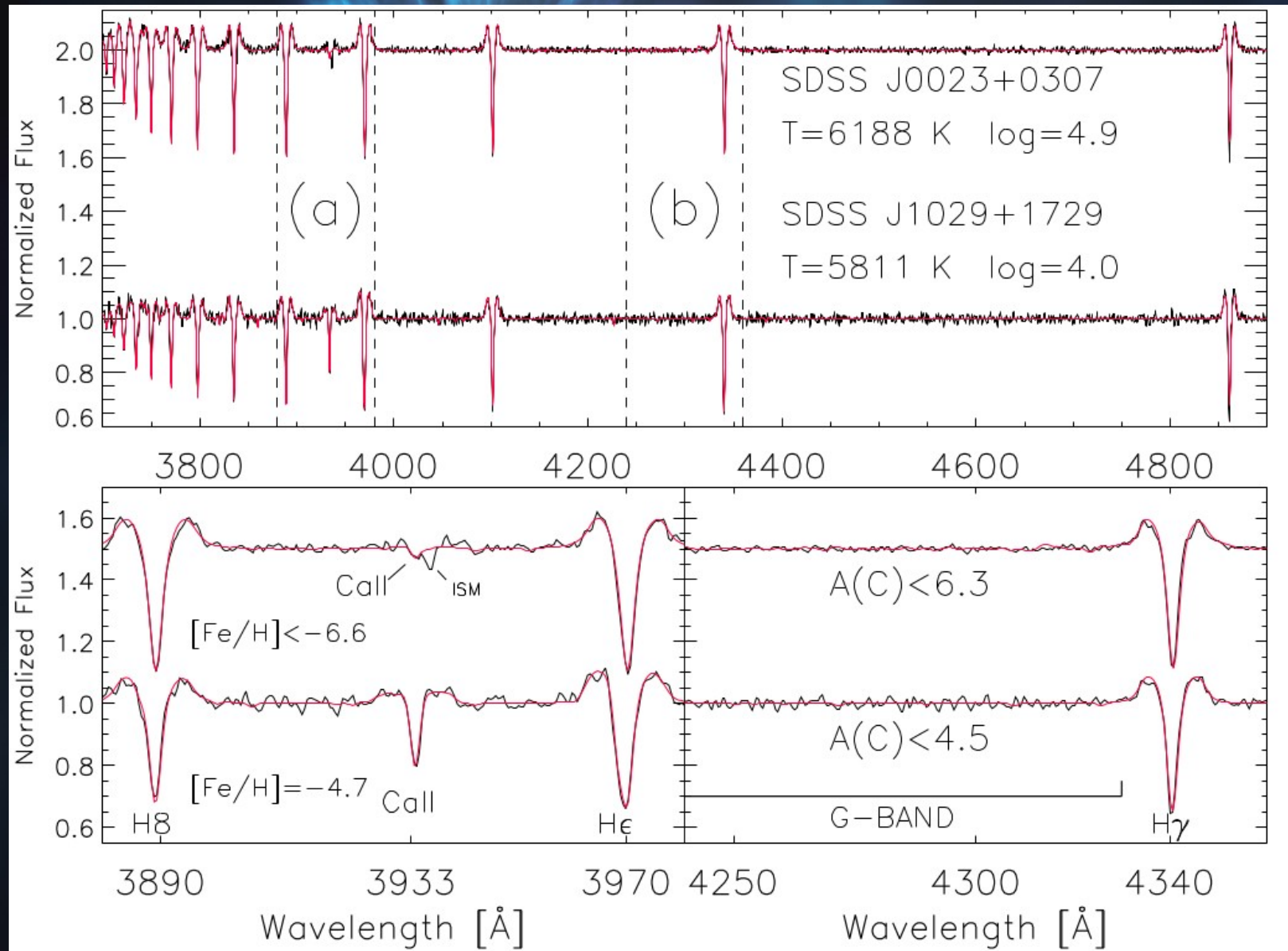
4-The Discovery of J0023+0307

Aguado+ (2018b)



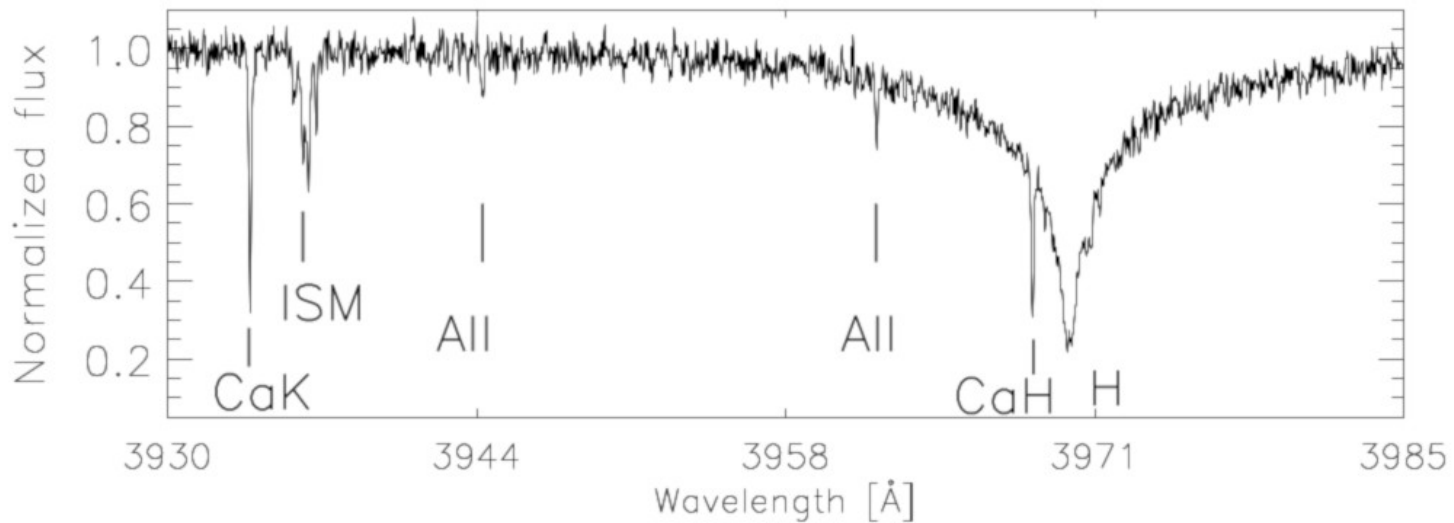
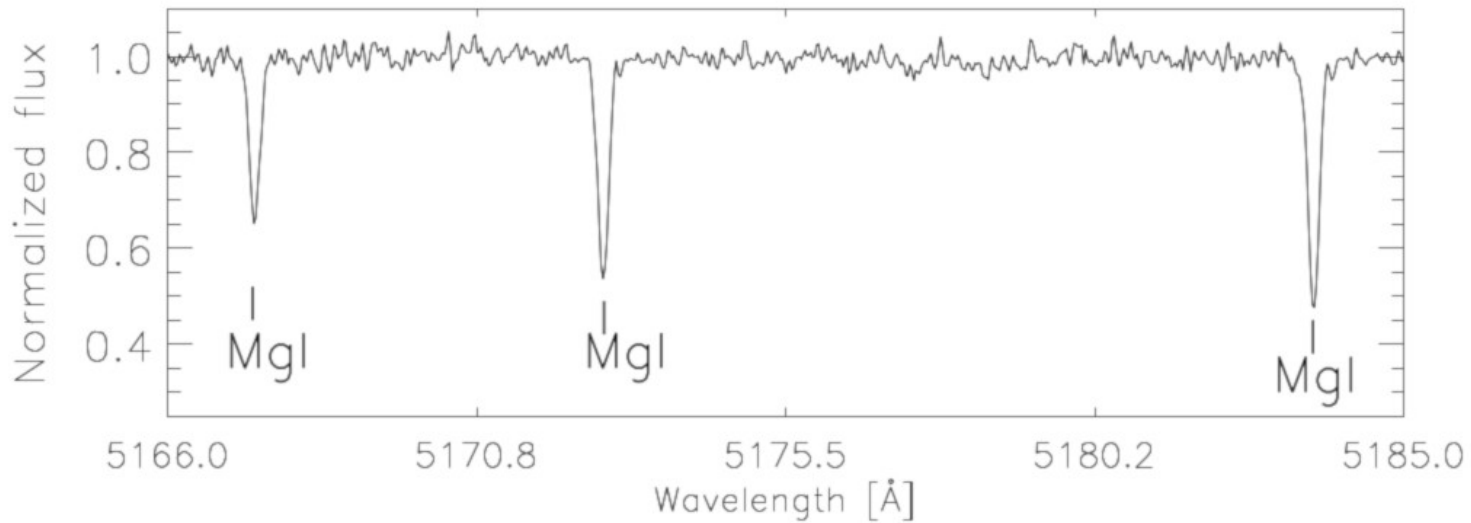
4-The Discovery of J0023+0307

Aguado+ (2018b) 極超金屬欠乏星 !!!



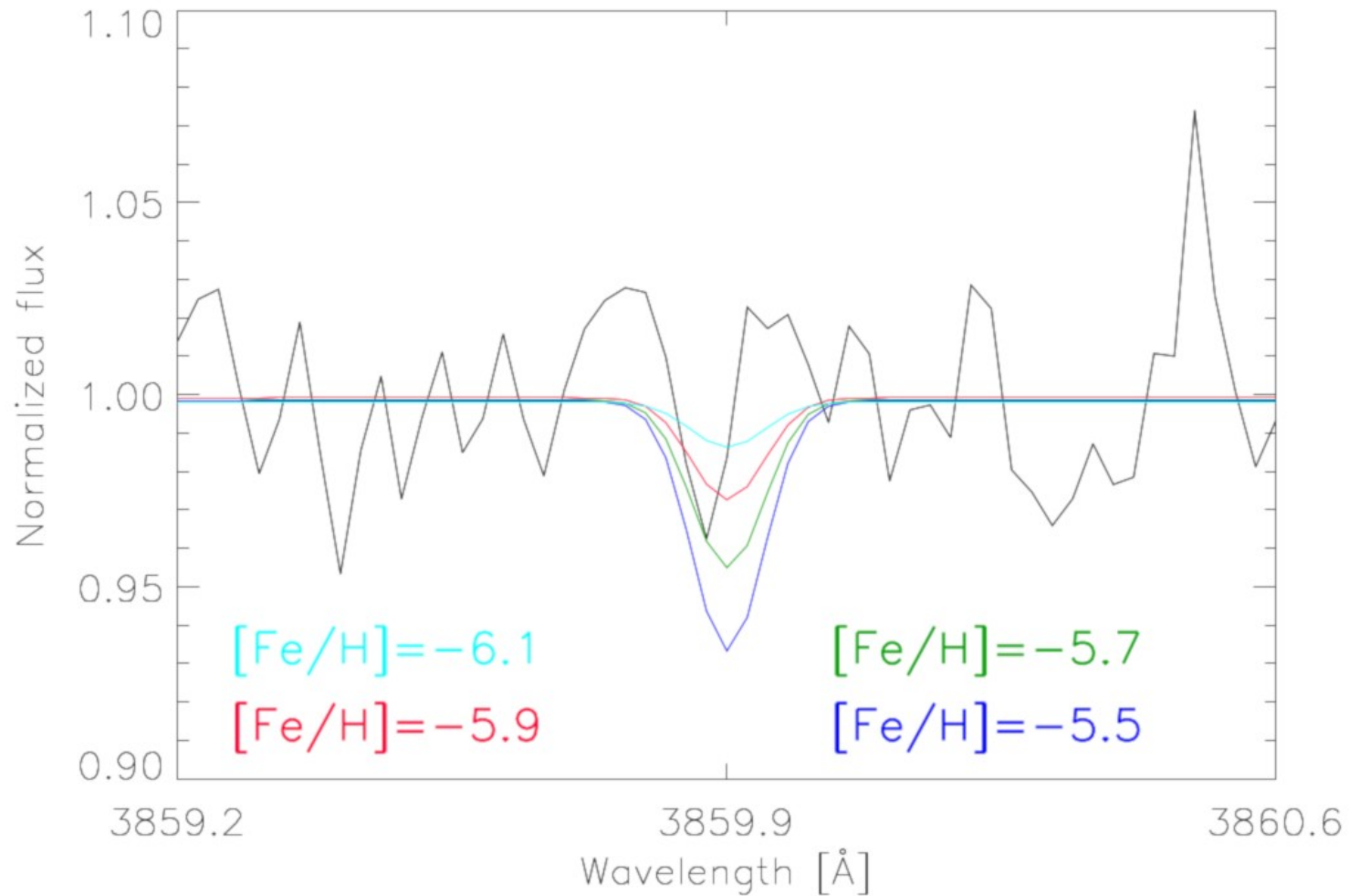
4-UVES spectrum of J0023+0307

Aguado+ (2018, submitted)



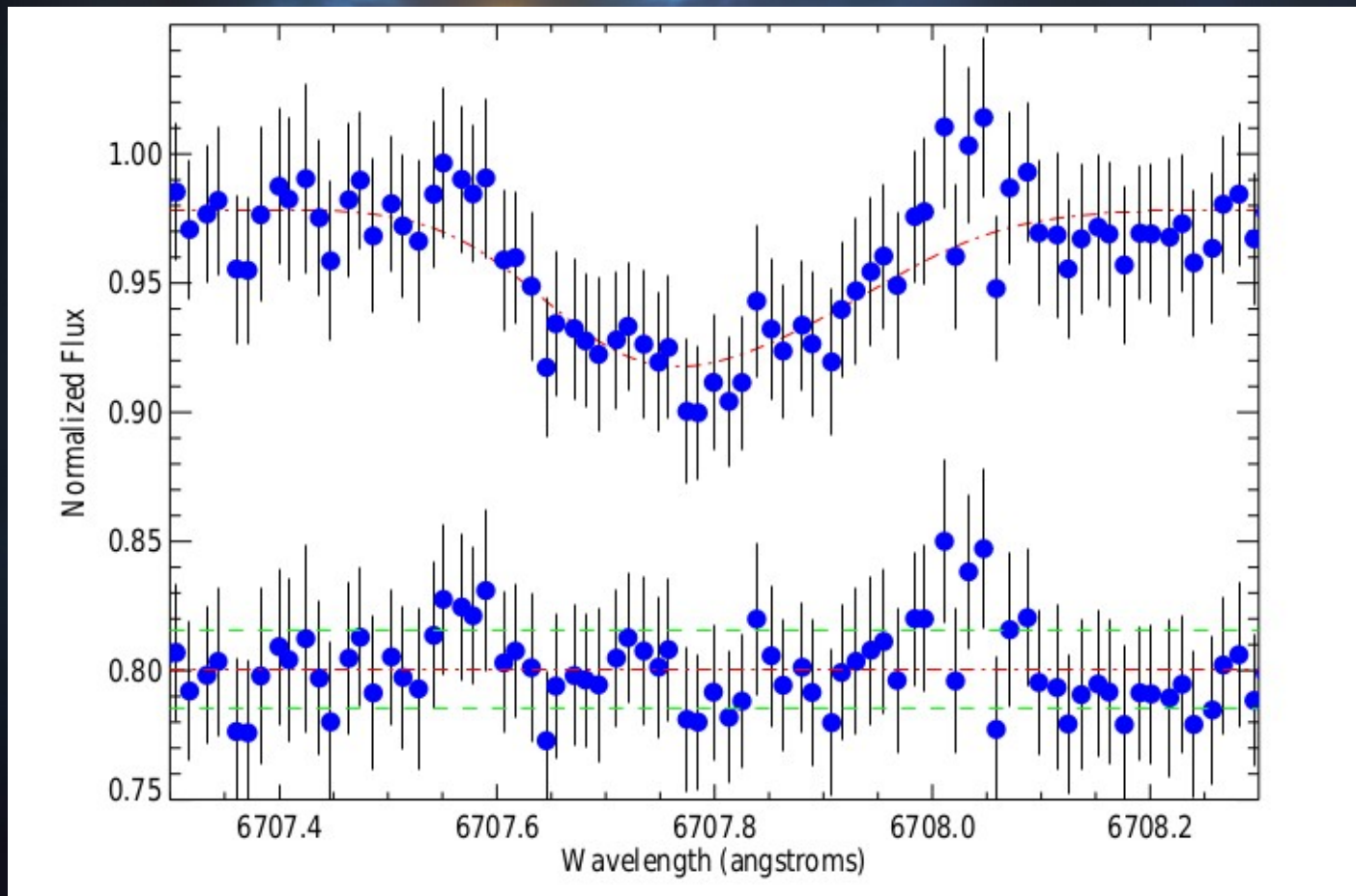
4-UVES spectrum of J0023+0307

Aguado+ (2018, submitted)



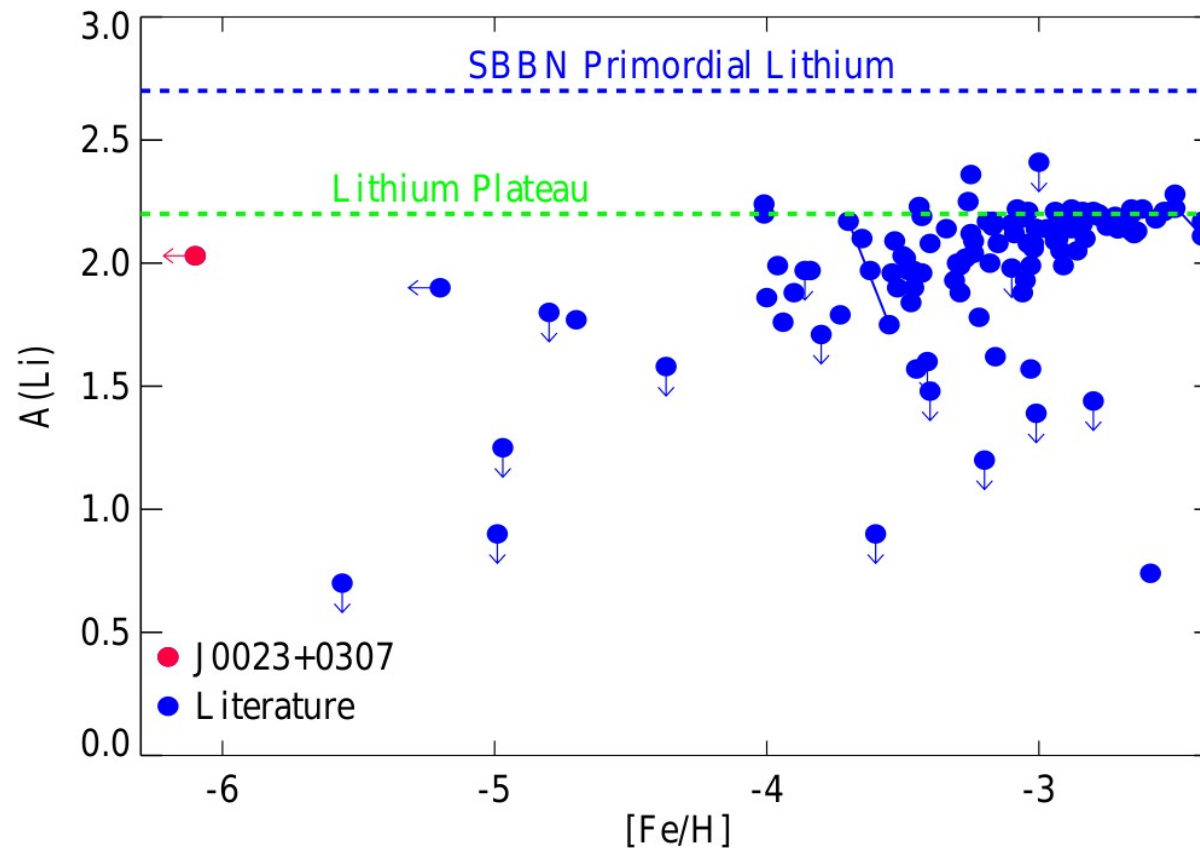
4-UVES spectrum J0023+0307

Aguado+ (2018, submitted)



4-The Discovery of J0023+0307

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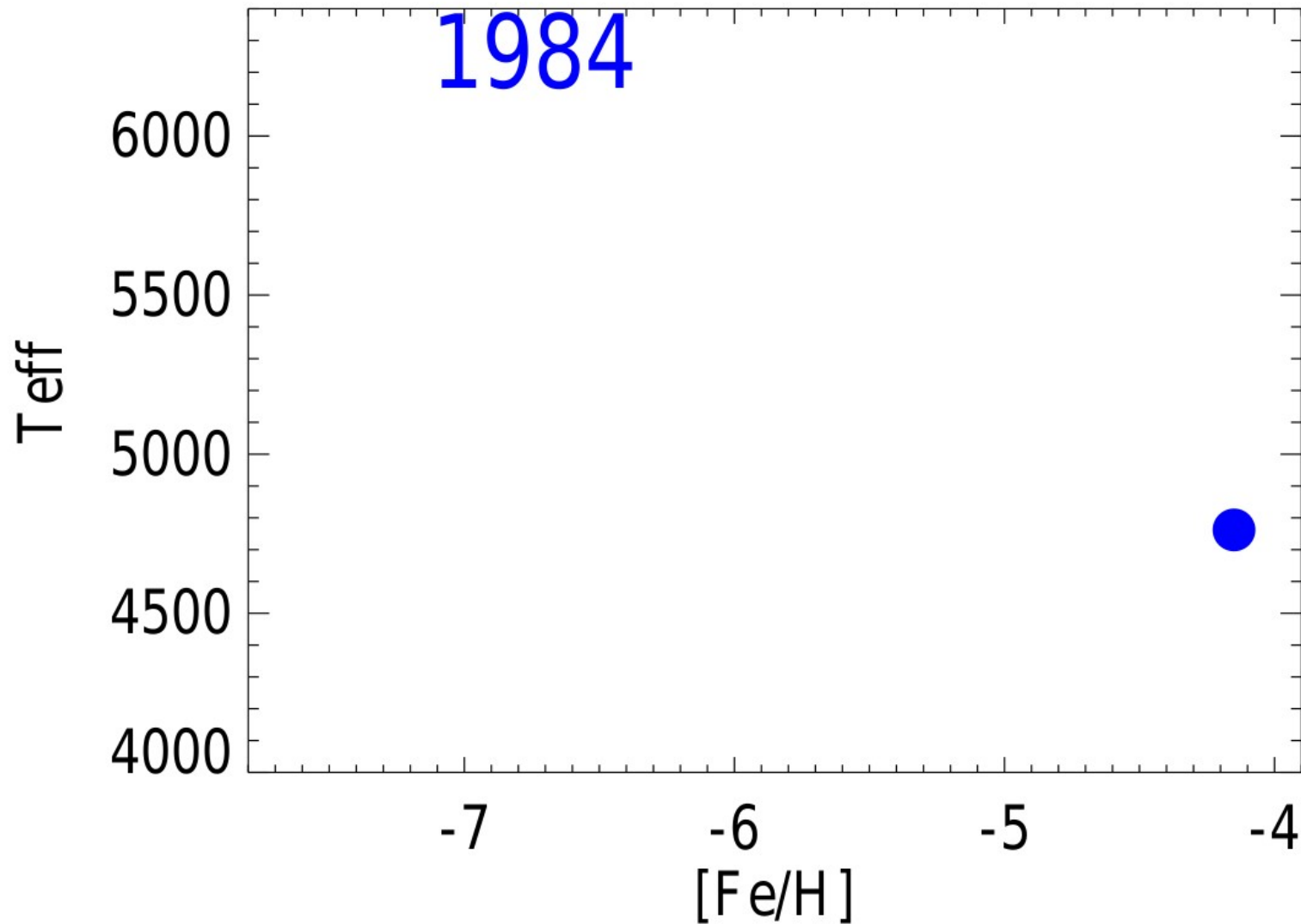
Aguado+ (2018, submitted)

Table 1: All the T_{eff} derived values considered in this work and explained in Section 3

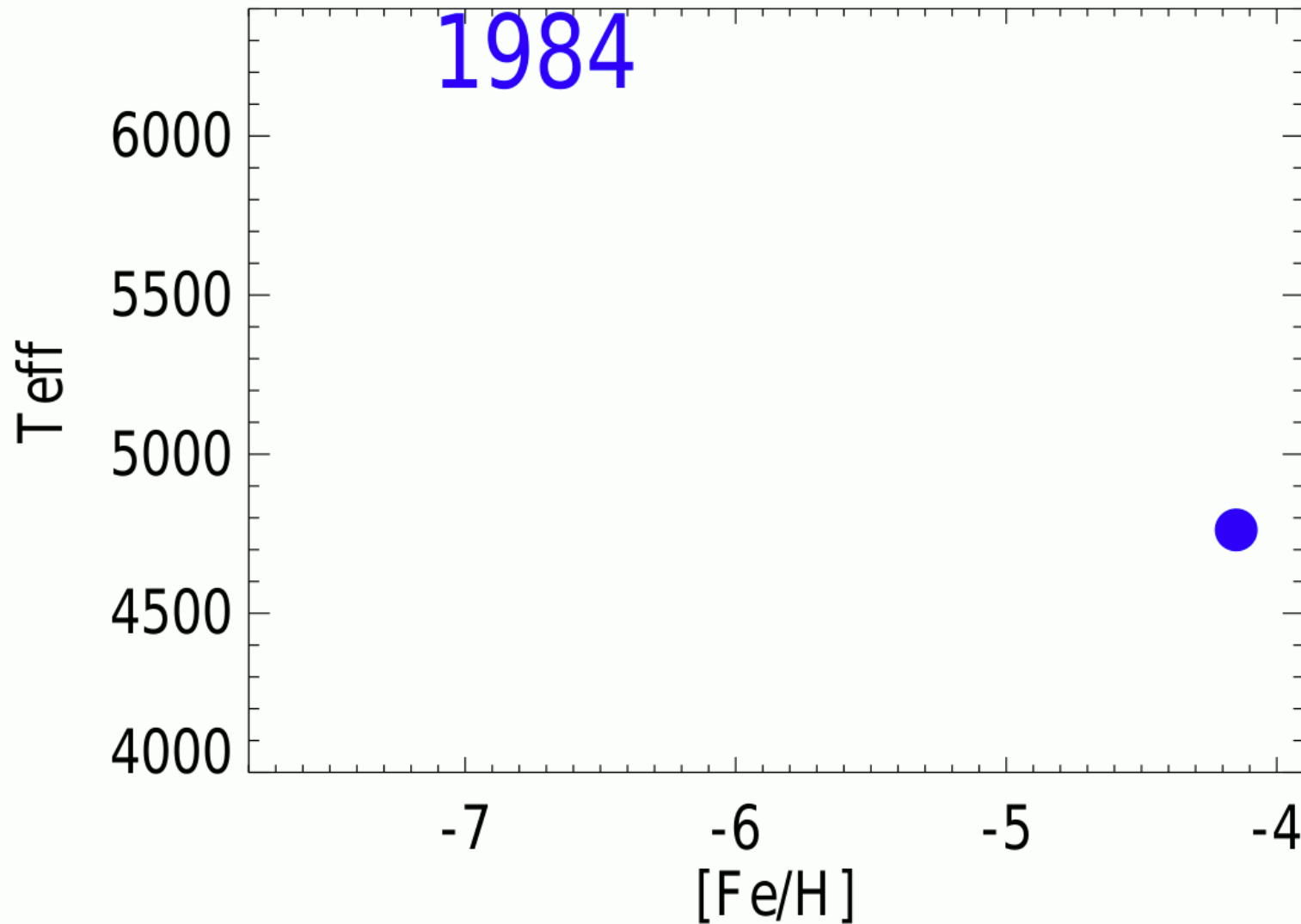
Source	Ref.	T_{eff}	δT
BOSS spectrum	(1)	6295	36
OSIRIS spectrum	(1)	6140	132
ISIS spectrum	(1)	6188	84
(g-z)	(2)	6160	100
H_{α}	(3)	6400	150
H_{β}	(3)	6165	62
IRFM	(4)	6482	224
(V-J)	(5)	6481	156
(V-H)	(5)	6335	186
(V- K_s)	(5)	6615	212
Mean V-X	(5)	6474	145
(V-I)	(5)	5992	157
(V-I)	(6)	5997	130

References: (1) Aguado et al. (2018a), (2) François et al. (2018), (3) This work, (4) González Hernández & Bonifacio (2009), (5) Casagrande et al. (2010), (6) Frebel et al. (2018)

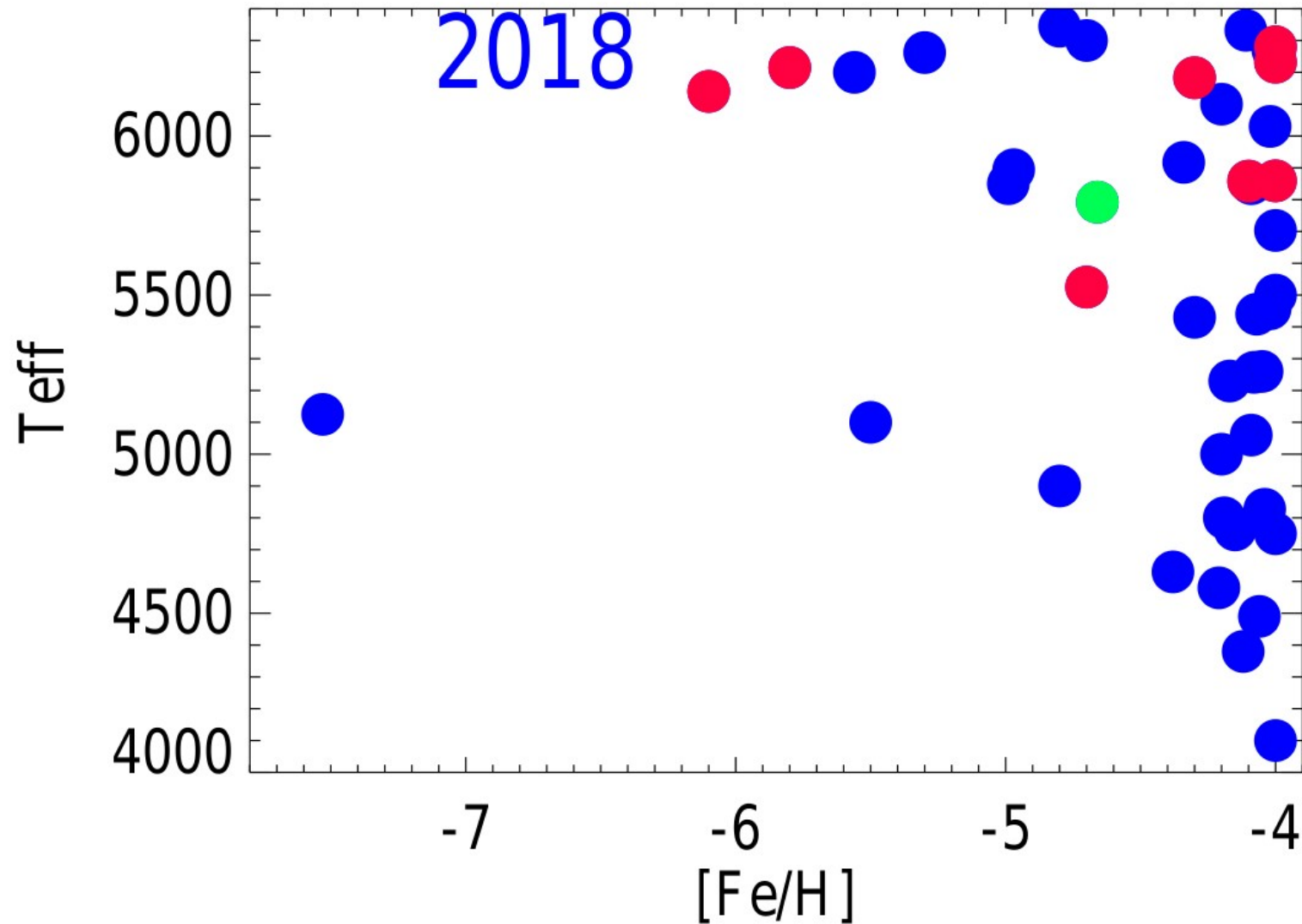
5-Summary



5-Summary



5-Summary



ありがとう！