SPECTRAL DECOMPOSITION OF HOT SUBDWARF BINARIES

Simon Kreuzer

P. Németh, A. Irrgang, U. Heber

Dr. Karl Remeis Sternwarte Bamberg

ERLANGEN CENTRE
FOR ASTROPARTICLE
PHYSICS

FRIEDRICH-ALEXANDER
UNIVERSITÄT
ERLANGEN-NÜRNBERG

Outline

HOT SUBDWARFS IN BINARY SYSTEMS

SINGLE-LINED SD

50% short period (P < 30d)
(Maxted et al., 2001)

DOUBLE-LINED SD

$P \approx 1000$d
$e \approx 0.11 - 0.16$
(Vos et al., 2013)

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- stable RLOF
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- phase dependent RLOF + circumbinary disk
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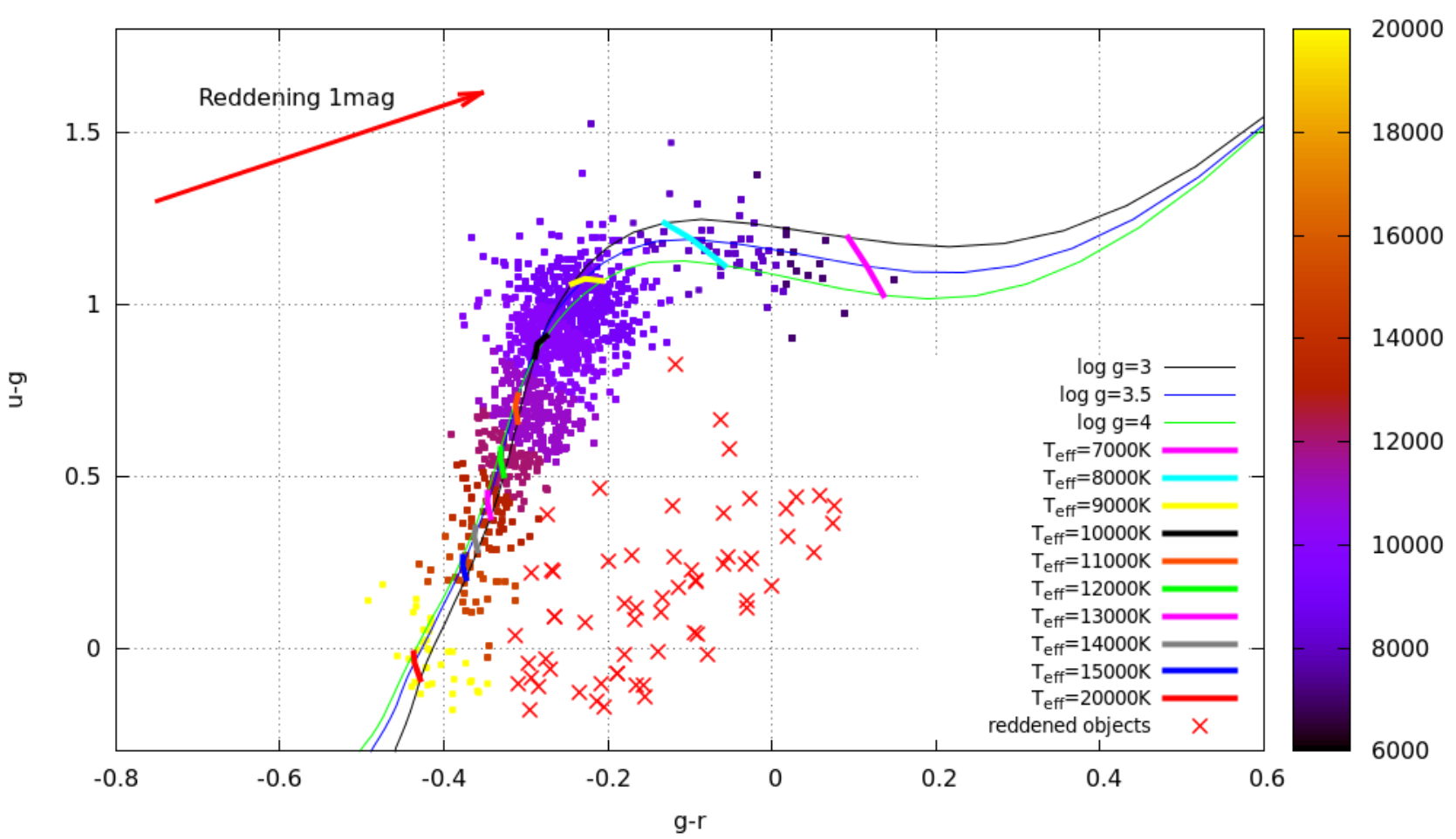
Spectrum of SD: No constraints concerning progenitor

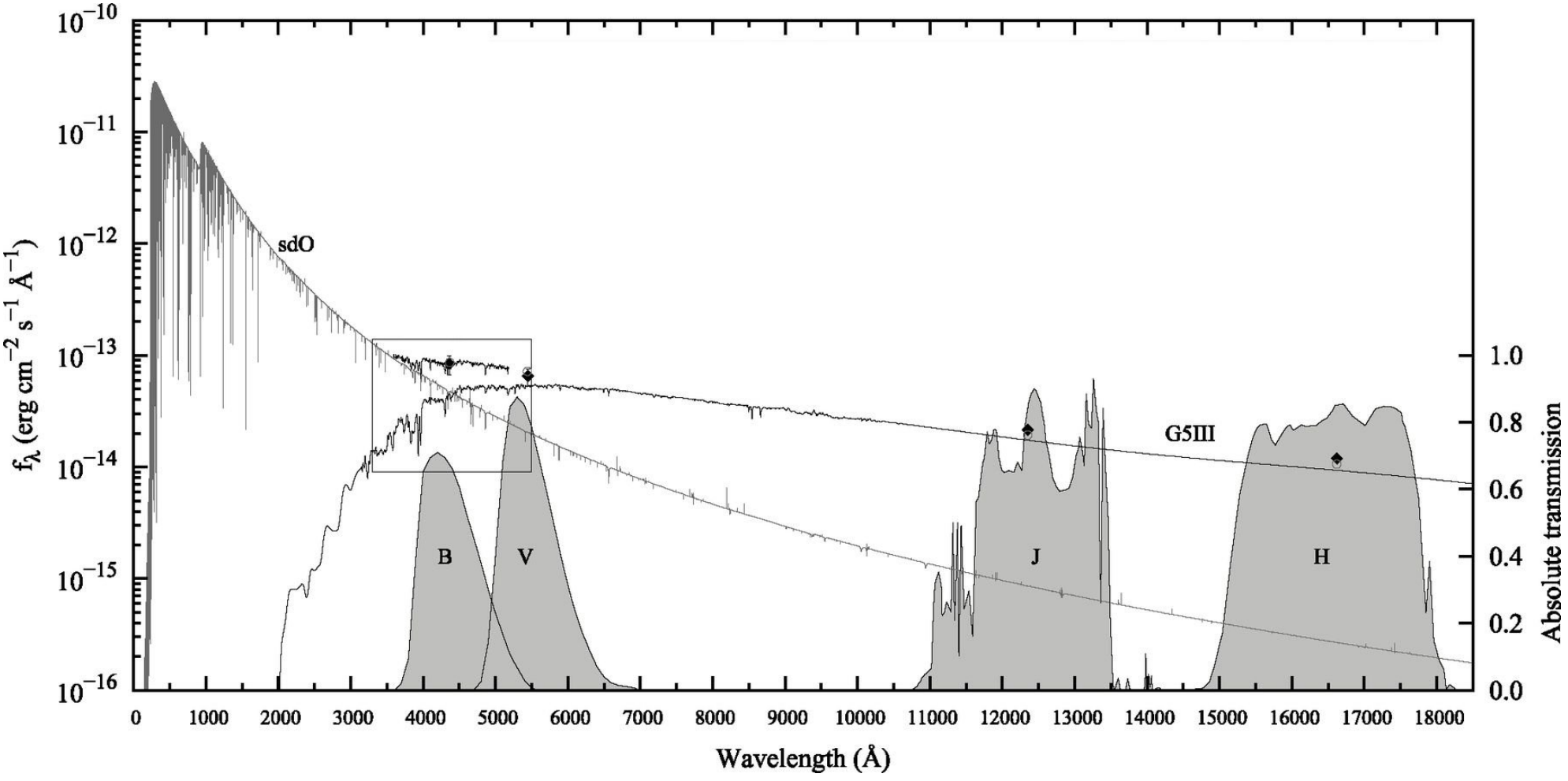
$\Rightarrow$ Cool companion provides information

Motivation



Color-color-diagram of the sample, over-plotted with lines of constant log g, and log g for constant temperature, according to Castelli & Kurucz (2004).

Red crosses may indicate SD binaries with G/F-type companion

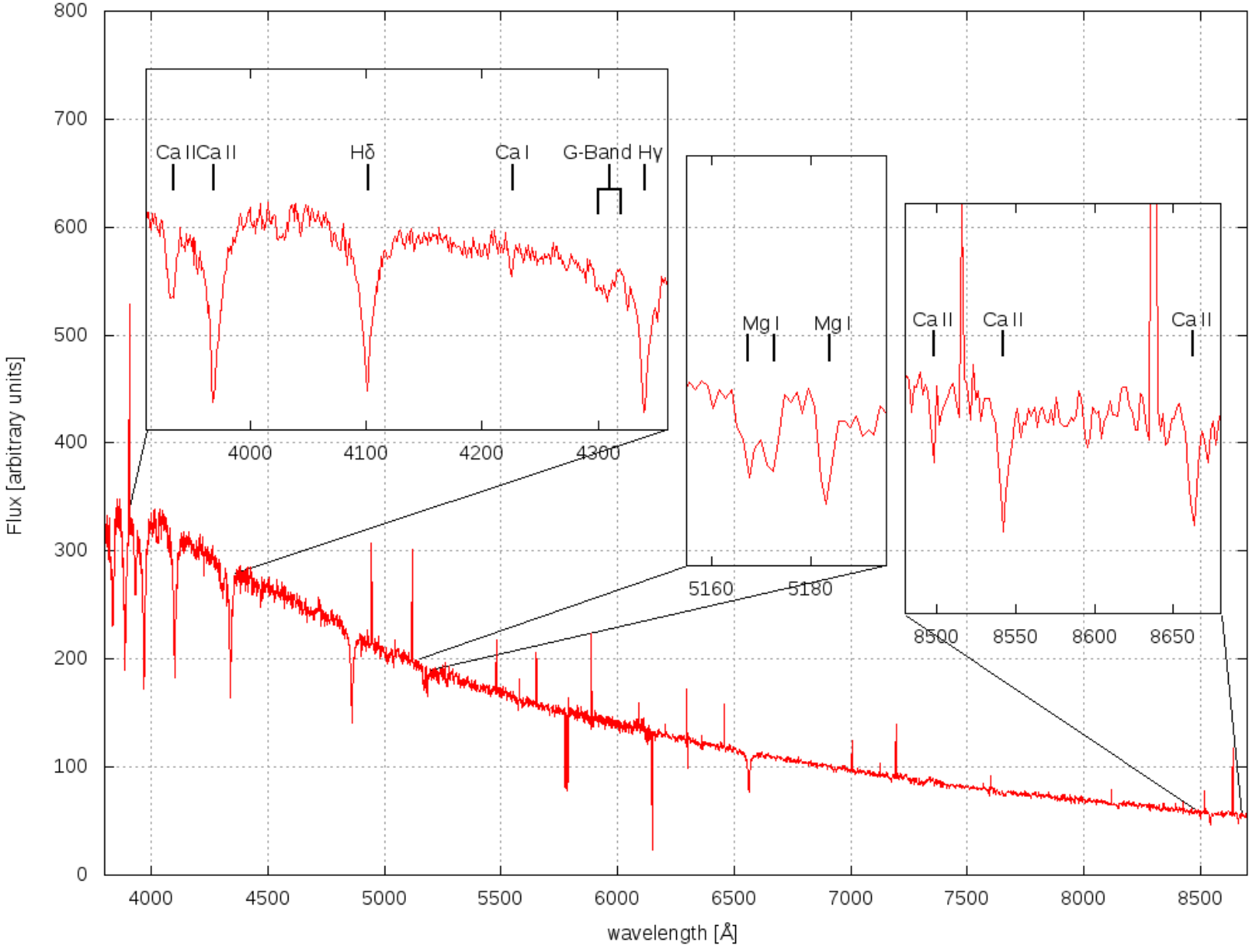


(From P. Nemeth et al. 2012)

POSTER RECOMMENDATION: DIFFERENT APPROACH

Johannes Schaffenroth

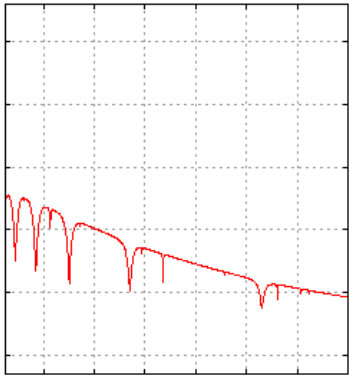
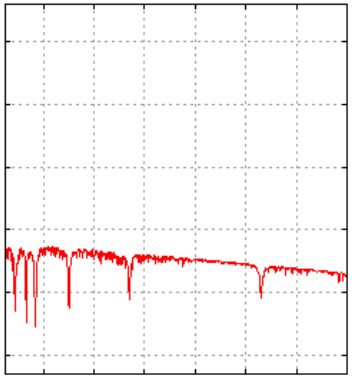
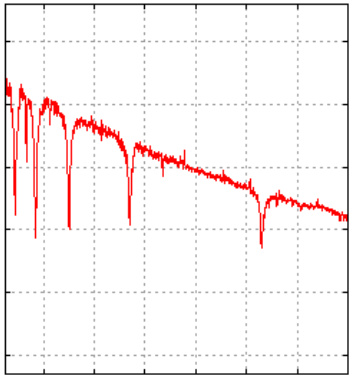
Spectral energy distributions of binary sdB stars



observed spectrum of candidate SDSS J1351-0801
Lines that are a hint on the presence of a cool companion are marked

SPECTRAL DISENTANGLING

SD-spectrum + MS-Spectrum = observed spectrum

- flux calibrated spectra from Sloan Digital Sky Survey
- spectral range: 3800-9200 Å / 3650-10400 Å

THE LIBRARIES

SUBDWARF LIBRARY

(P. Nemeth, 2013)

non-LTE

	lower limit	stepsize	upper limit
T_{eff} [K]	20000	1000	56000
log g	5.0	0.1	6.3
[He/H]	0.0005	$\times 2$	100

Spectral range: 3200 - 7200 Å

PHOENIX LIBRARY

(T. Husser et al., 2013)

	lower limit	stepsize	upper limit
T_{eff} [K]	2300	100/200	12000
log g	0	0.5	6.0
log [Fe/H]	-4	1 ($\pm$ 0.5)	1

Spectral range: 500 - 55000 Å

Implementation

- 9 free parameters:

MS				sdB				
T_{eff}	log g	Fe/H	RV	T_{eff}	log g	He/H	RV	flux ratio

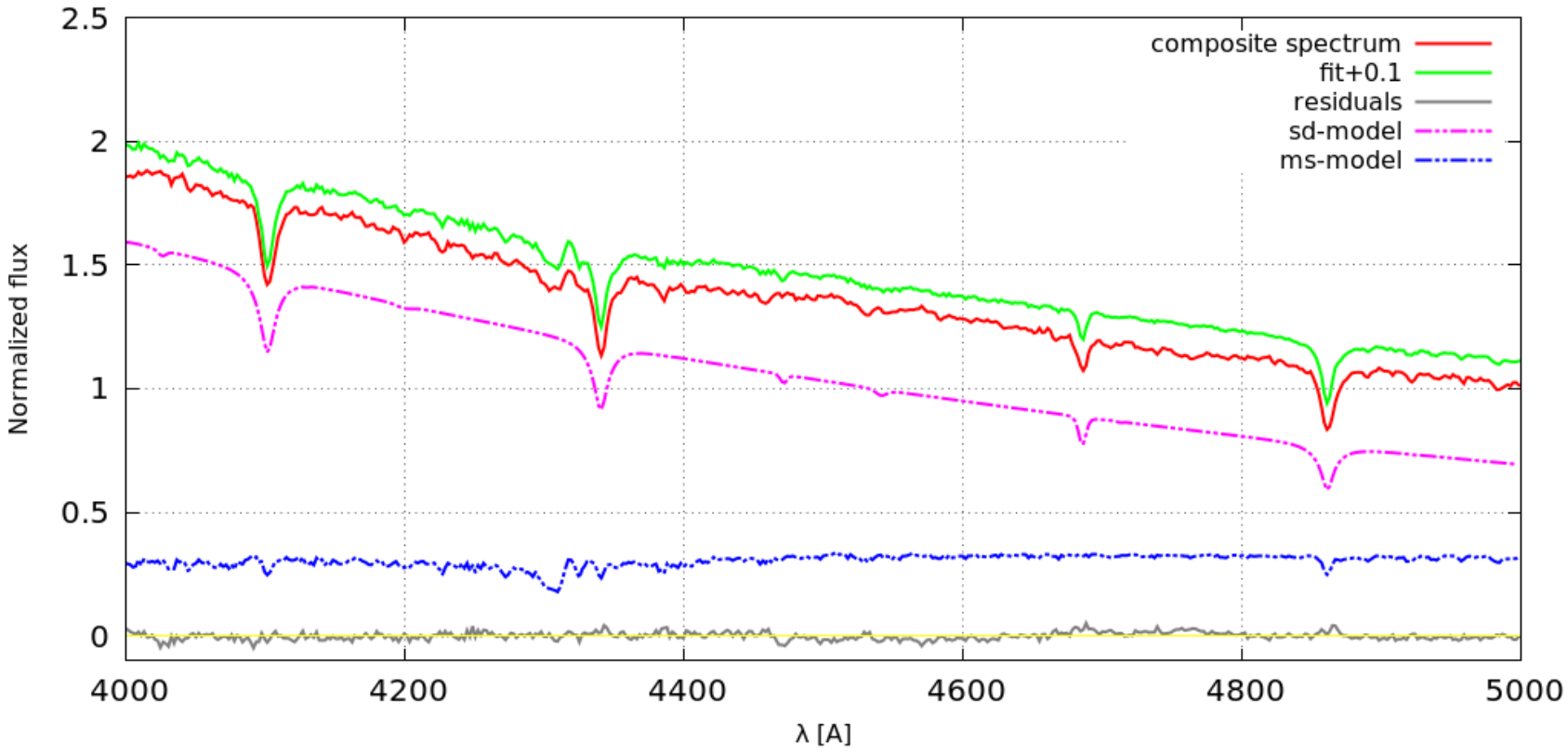
- generate synthetic composite spectrum
- determine χ^2
- change parameters and try to minimize χ^2 using standard simplex routine
- reinitialize simplex to ensure global minimum was found

- global fit at once
- code written from scratch in C++

Known issues

- extended subdwarf library needed to include CAII-IR-triplet in the fit
- huge impact of the quality of flux calibration
  $\Rightarrow$ Split spectrum into small parts
- error treatment
- large impact of low RV-shifts
  $\Rightarrow$ Good startvalues

GALEXJ1602+0725



MS			sdO		
T_{eff}	log g	[Fe/H]	T_{eff}	log g	[He/H]
5576 K	4.05 dex	-1.09 dex	49000 K	5.76 dex	-1.95 dex

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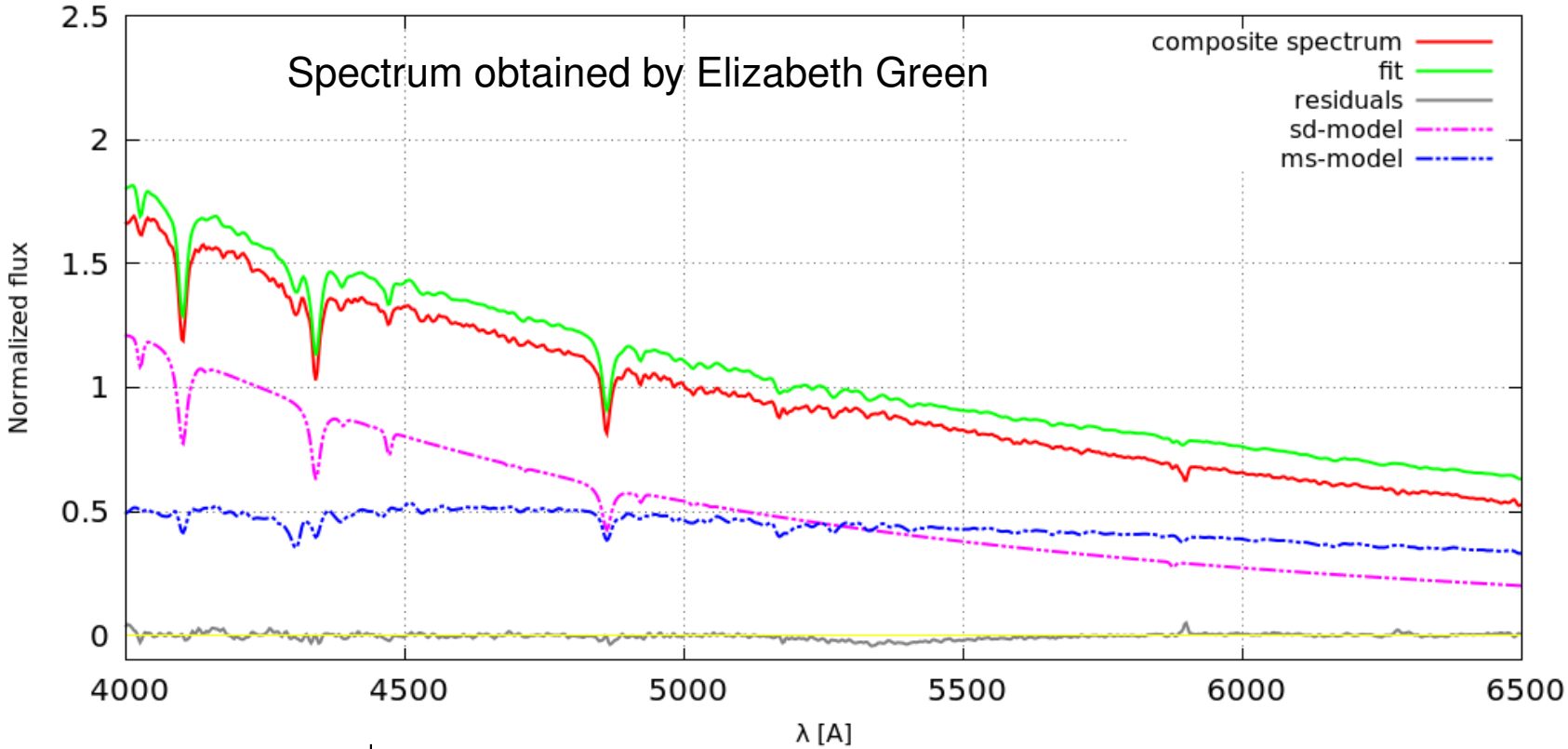


	MS		
	T_{eff}	log g	[Fe/H]
this work	6220 K	4.60 dex	-0.24
Vos et al. 2012	5970 ± 160 K	4.29 ± 0.05 dex	-0.58 ± 0.11 dex
	sdB		
	T_{eff}	log g	[He/H]
this work	32528 K	5.88 dex	-1.53 dex
Vos et al. 2012	33810 ± 1200 K	5.85 ± 0.08 dex	*-1.52 dex*

Applications and Goals

Goals

- fast, simple yet powerful fitroutine
- application to large sample (SDSS)
- disentangle SD + MS binaries to unravel their formation history

Long term goals

- more parameters like abundances
- extension to disentangle triple or multiple star systems

Wide field of use

- libraries easily exchangeable
- disentangle all kinds of binaries in all spectral regimes
- constrain orbital parameters of binaries due to RV-shifts

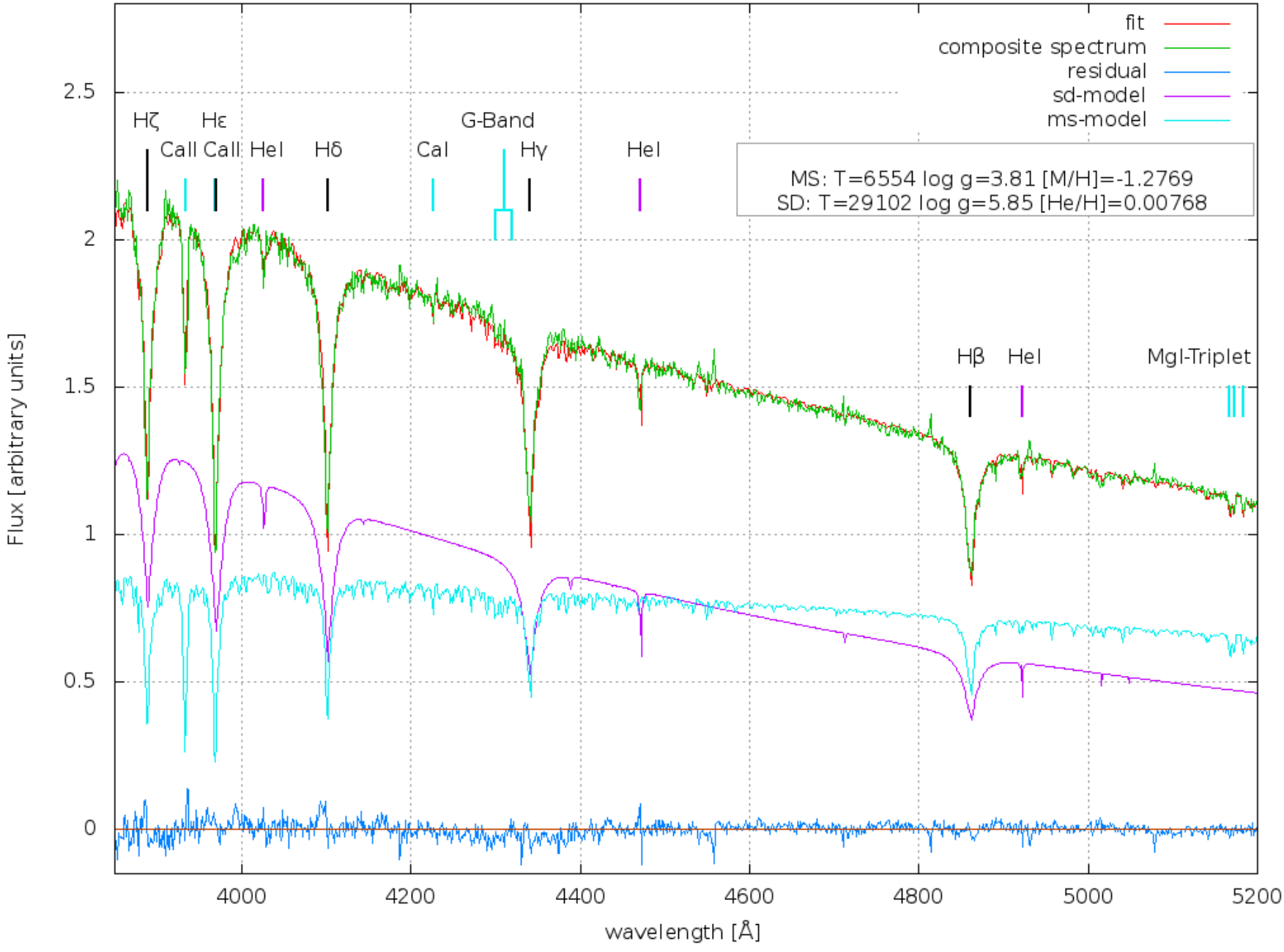
Outlook & Summary

Summary

- simple and fast fitroutine
- ability to fit binary spectra
- adaptive software for a variety of use cases

Outlook

- automated search for binaries in a large sample
- find systems with special characteristics for follow-up observations
- application to high resolution spectra



Candidate: SDSS J1619-2407