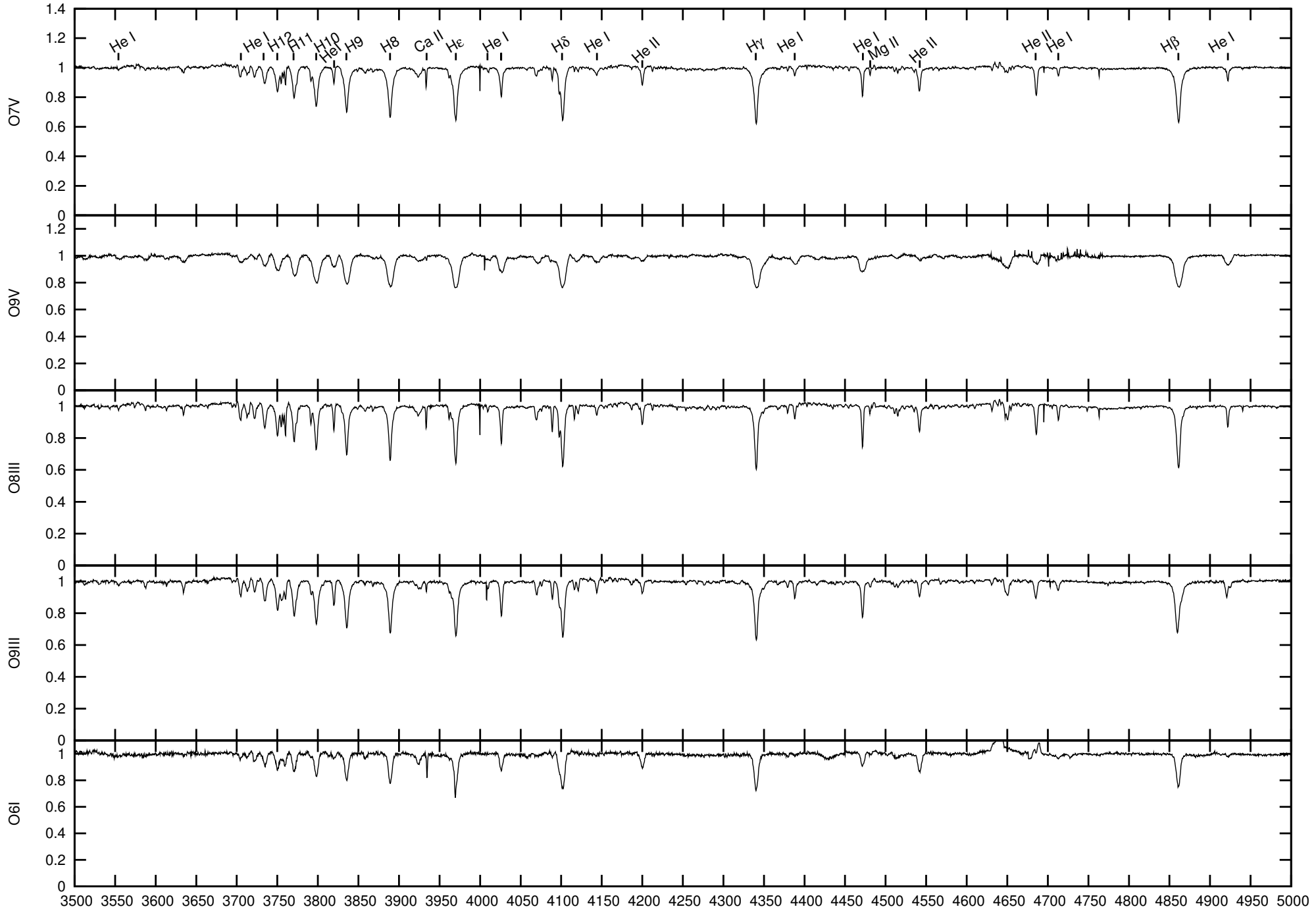
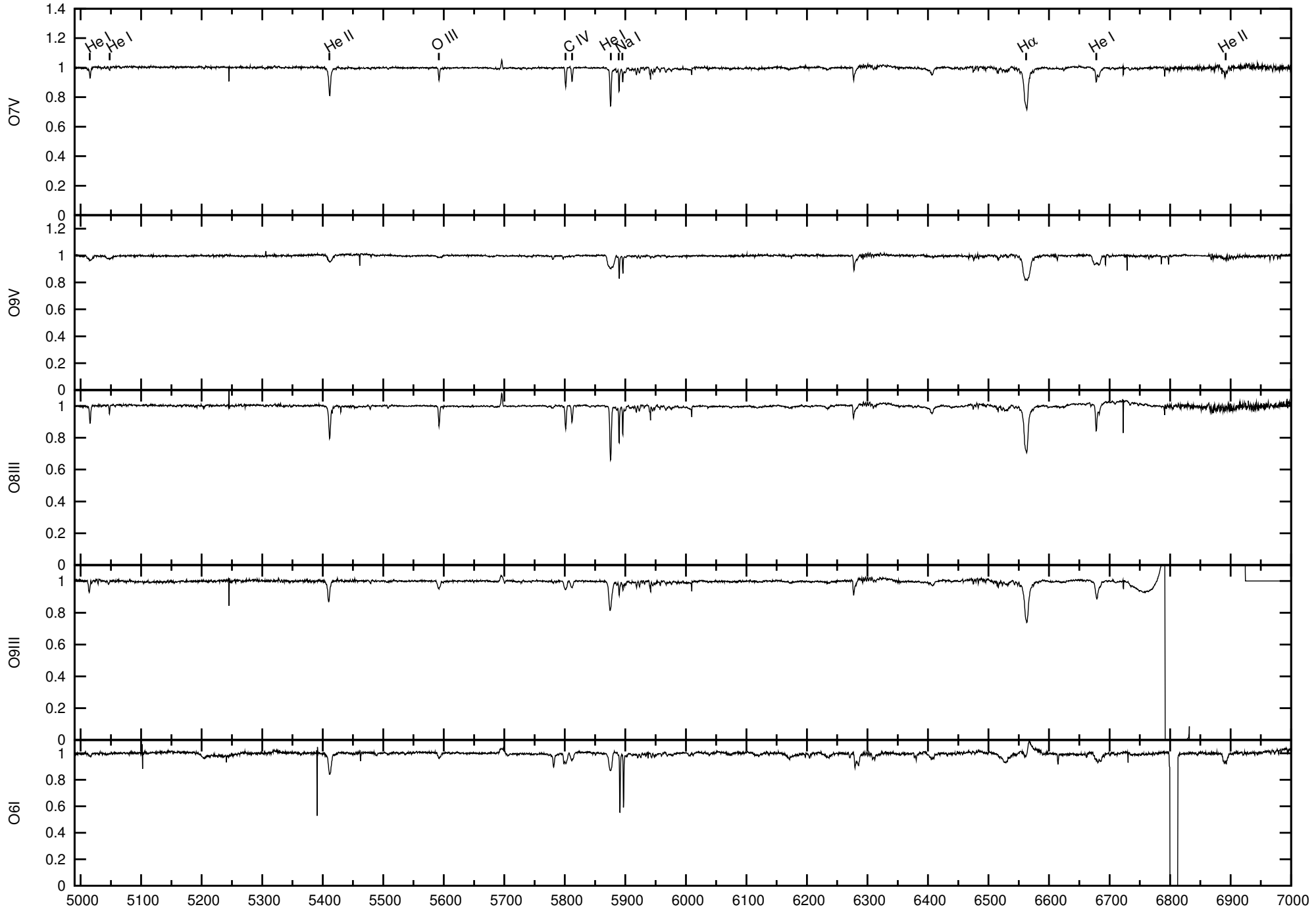

O7V
O9V
O8III
O9III
O6I
He I
He I
H12
H11
H10
He I
H9
H8
Ca II
Hε
He I
Hδ
He I
He II
Hγ
He I
He I
Mg II
He II
He II
He I
Hβ
He I
0
0.2
0.4
0.6
0.8
1
1.2
1.4
3500 3550 3600 3650 3700 3750 3800 3850 3900 3950 4000 4050 4100 4150 4200 4250 4300 4350 4400 4450 4500 4550 4600 4650 4700 4750 4800 4850 4900 4950 5000


He I
He I
He II
O III
C IV
He I
Na I
Hα
He I
He II
O7V
O9V
O8III
O9III
O6I
5000
5100
5200
5300
5400
5500
5600
5700
5800
5900
6000
6100
6200
6300
6400
6500
6600
6700
6800
6900
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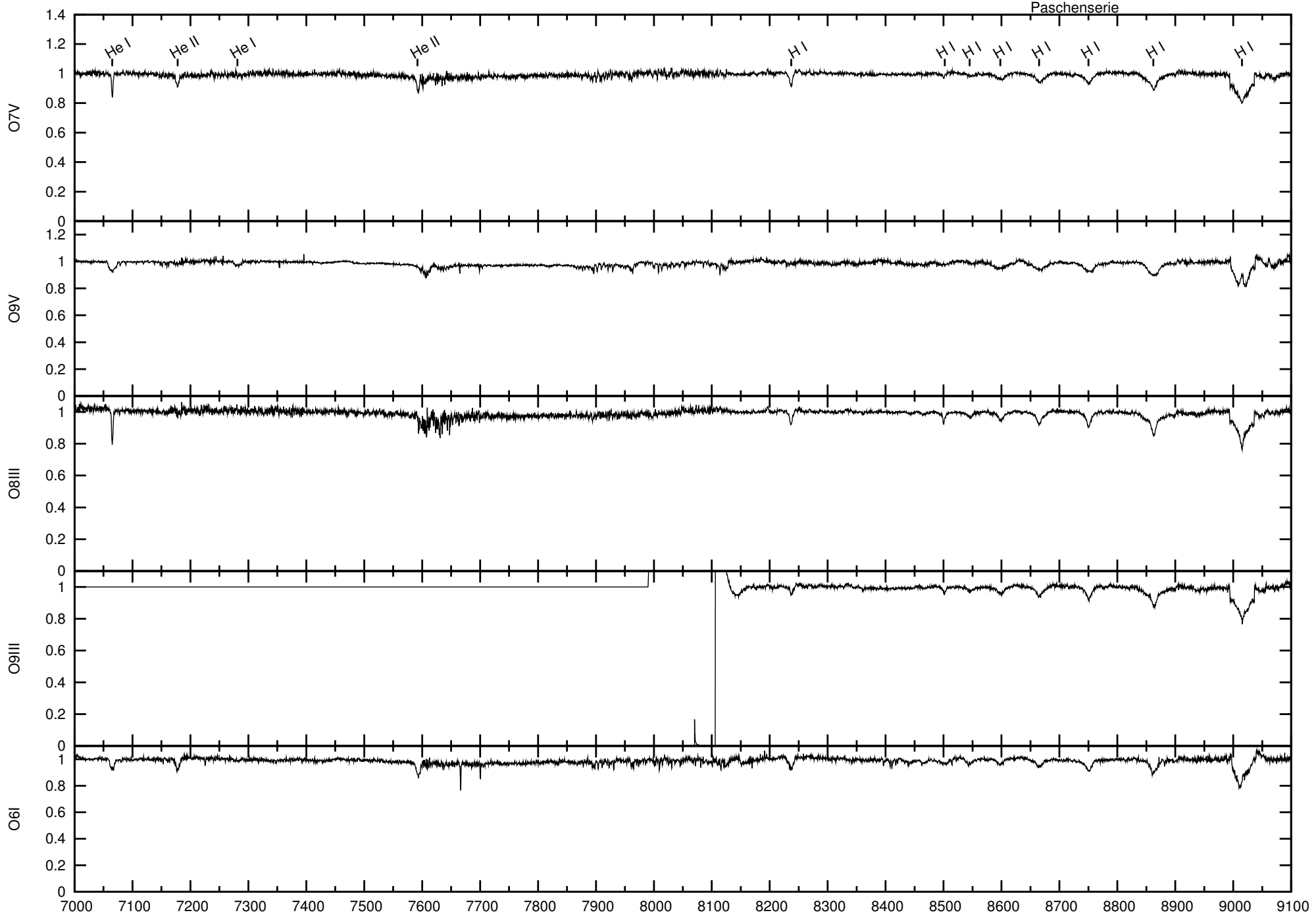
Paschenserie
He I
He II
He I
He II
H I
H I
H I
H I
H I
H I
H I
H I
O7V
O9V
O8III
O9III
O6I
1.4
1.2
1
0.8
0.6
0.4
0.2
0
7000
7100
7200
7300
7400
7500
7600
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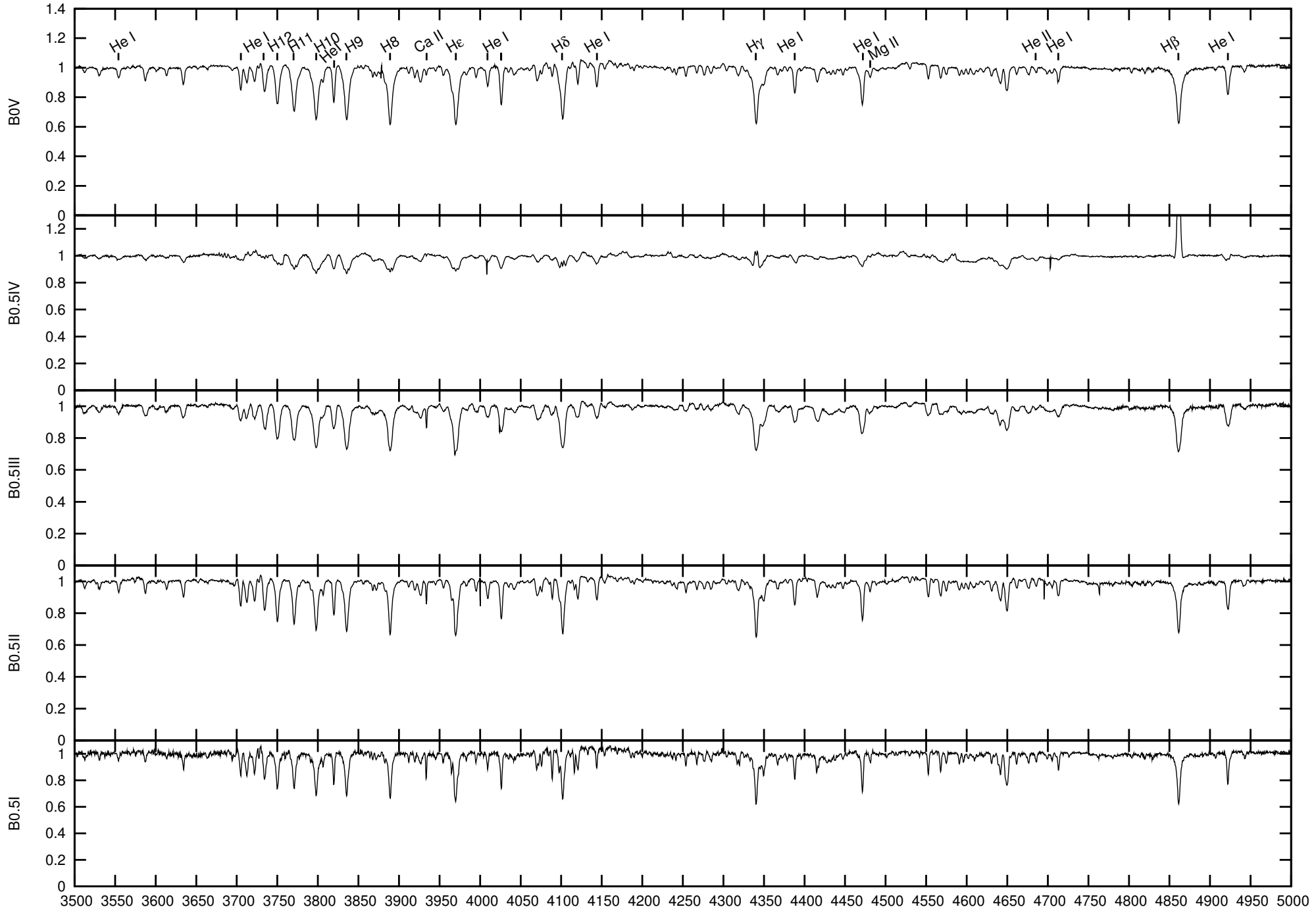
He I
He I
H12
H11
H10
He I
H9
H8
Ca II
Hε
He I
Hδ
He I
Hγ
He I
He I
Mg II
He II
He I
Hβ
He I
B0V
B0.5IV
B0.5III
B0.5II
B0.5I
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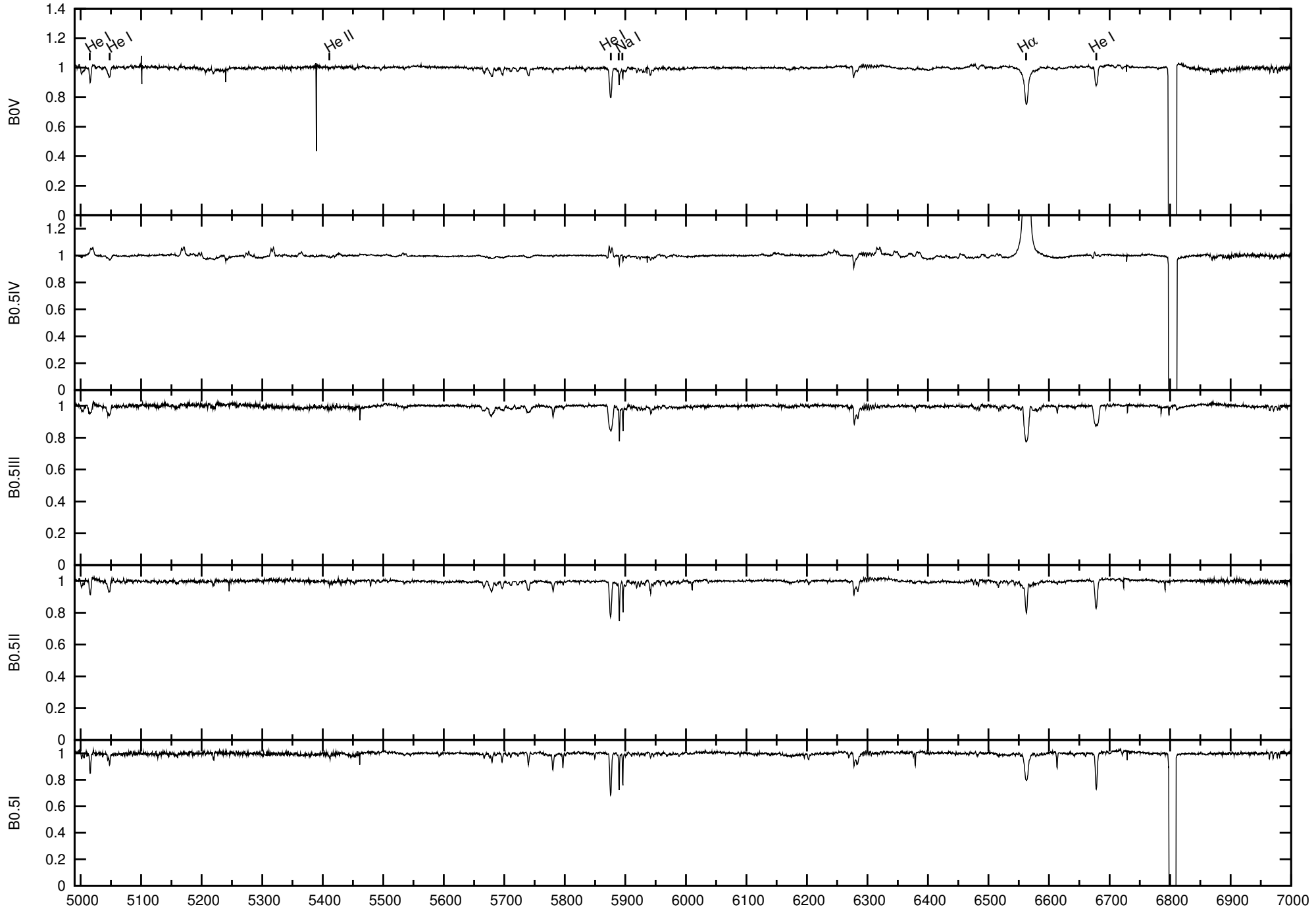
He I
He I
He II
He I
Na I
Hα
He I
B0V
B0.5IV
B0.5III
B0.5II
B0.5I
5000
5100
5200
5300
5400
5500
5600
5700
5800
5900
6000
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6200
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6500
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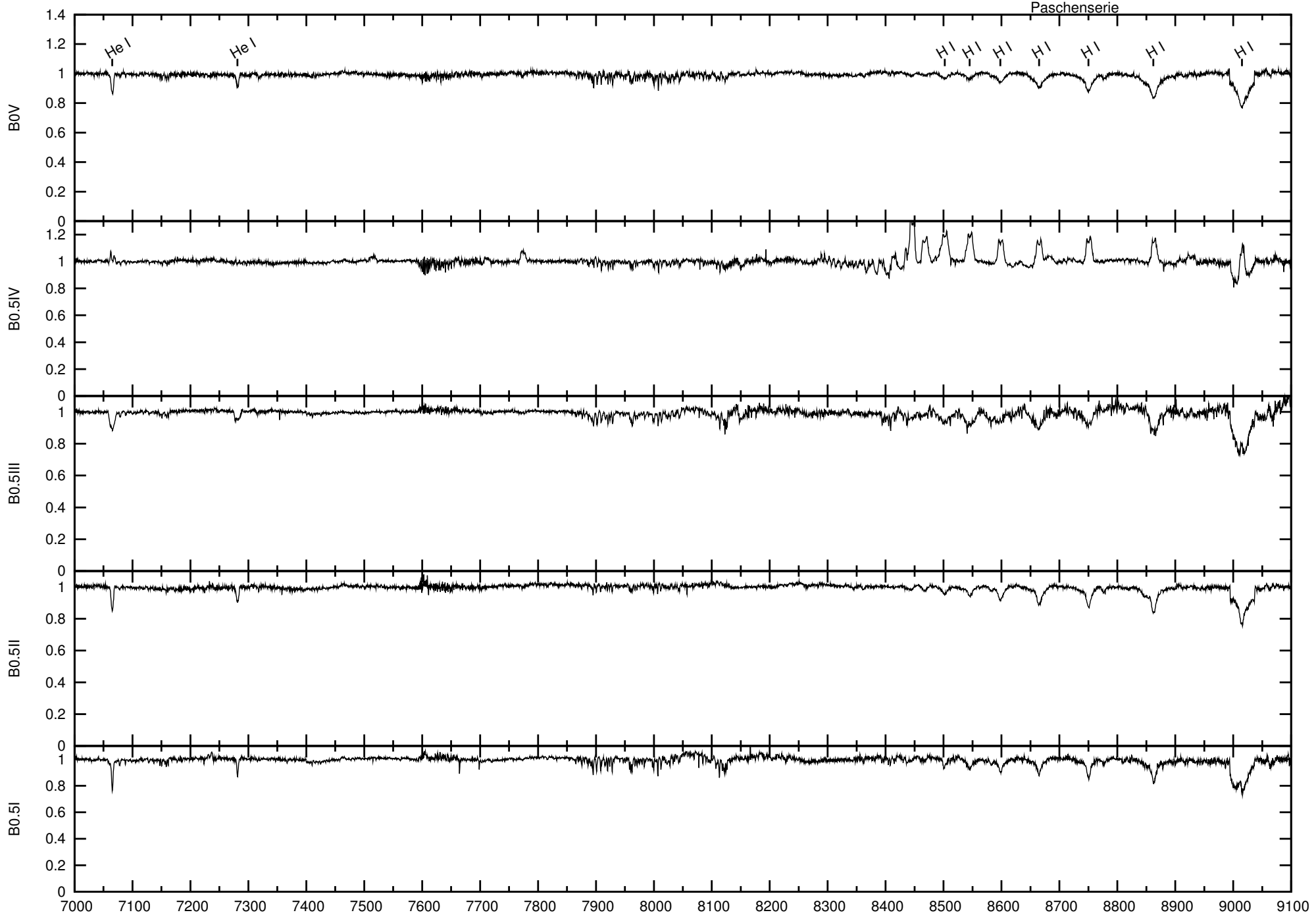
6900
7000


Paschenserie
He I
He I
H I
H I
H I
H I
H I
H I
H I
B0V
B0.5IV
B0.5III
B0.5II
B0.5I
7000
7100
7200
7300
7400
7500
7600
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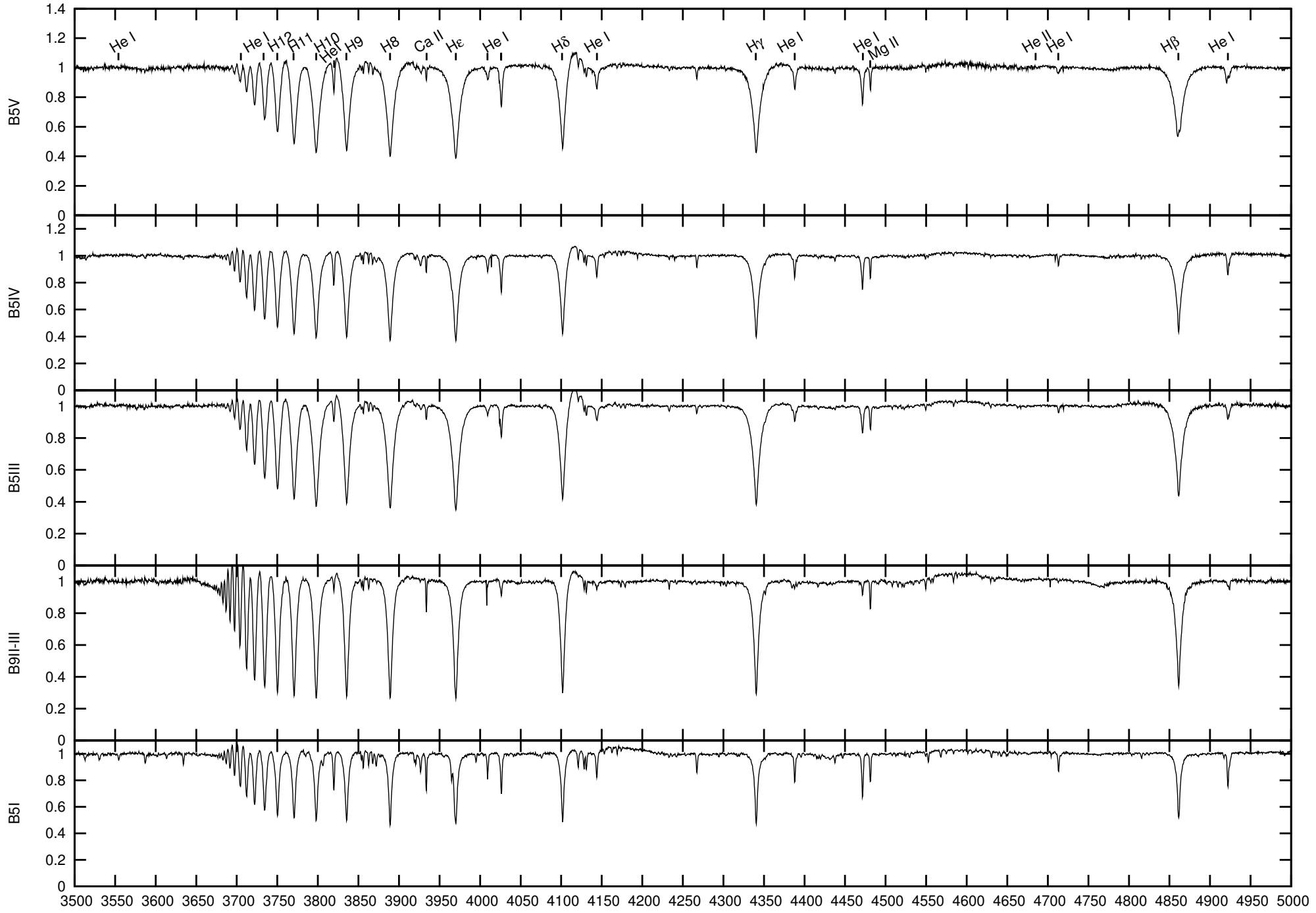
He I
He I
H12
H11
H10
He I
H9
H8
Ca II
Hε
He I
Hδ
He I
Hγ
He I
He I
Mg II
He II
He I
Hβ
He I
B5V
B5IV
B5III
B9II-III
B5I
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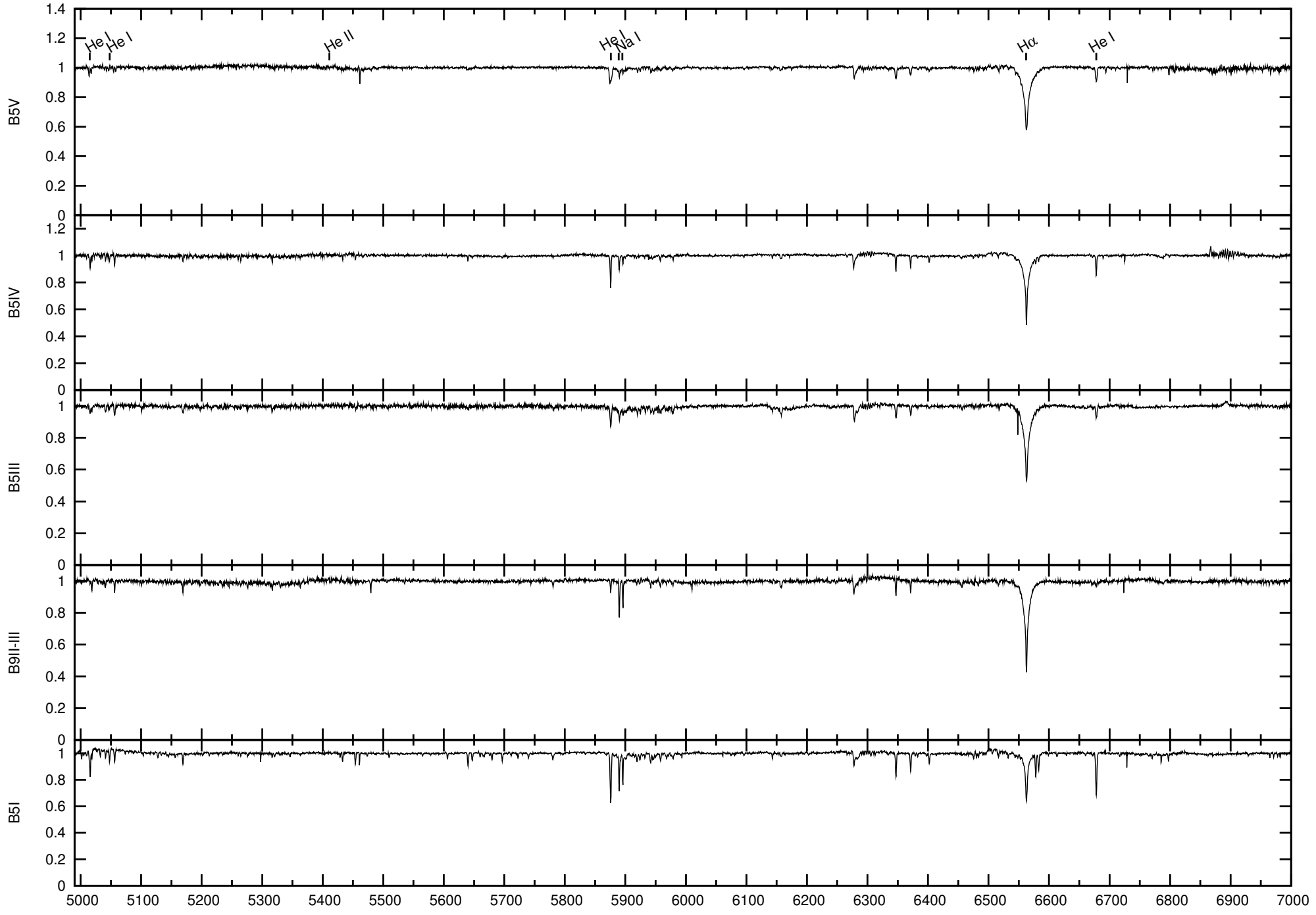
He I
He I
He II
He I
Na I
Hα
He I
B5V
B5IV
B5III
B9II-III
B5I
5000
5100
5200
5300
5400
5500
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6000
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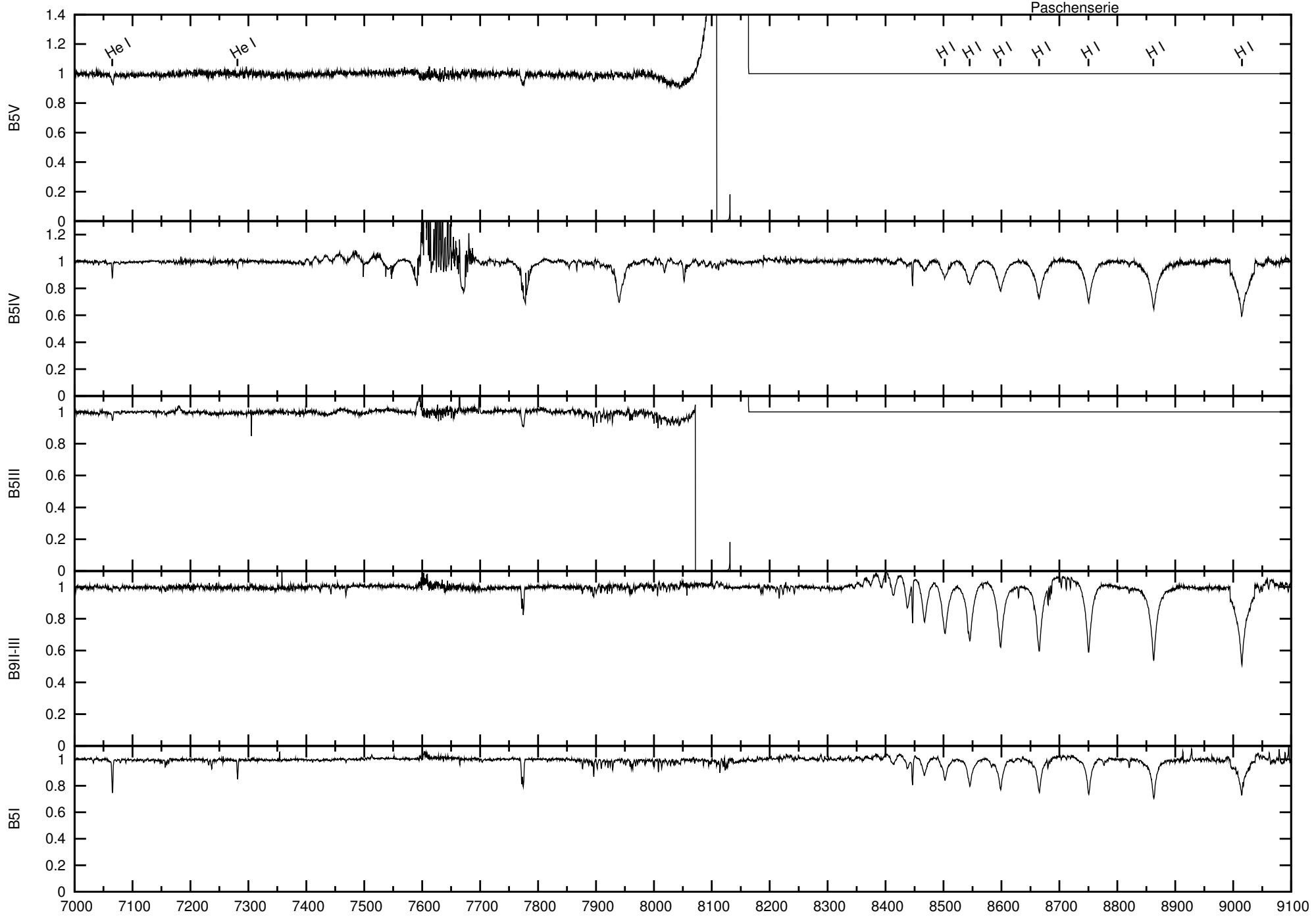
Paschenserie
He I
He I
H I
H I
H I
H I
H I
H I
H I
B5V
B5IV
B5III
B9II-III
B5I
1.4
1.2
1
0.8
0.6
0.4
0.2
0
7000
7100
7200
7300
7400
7500
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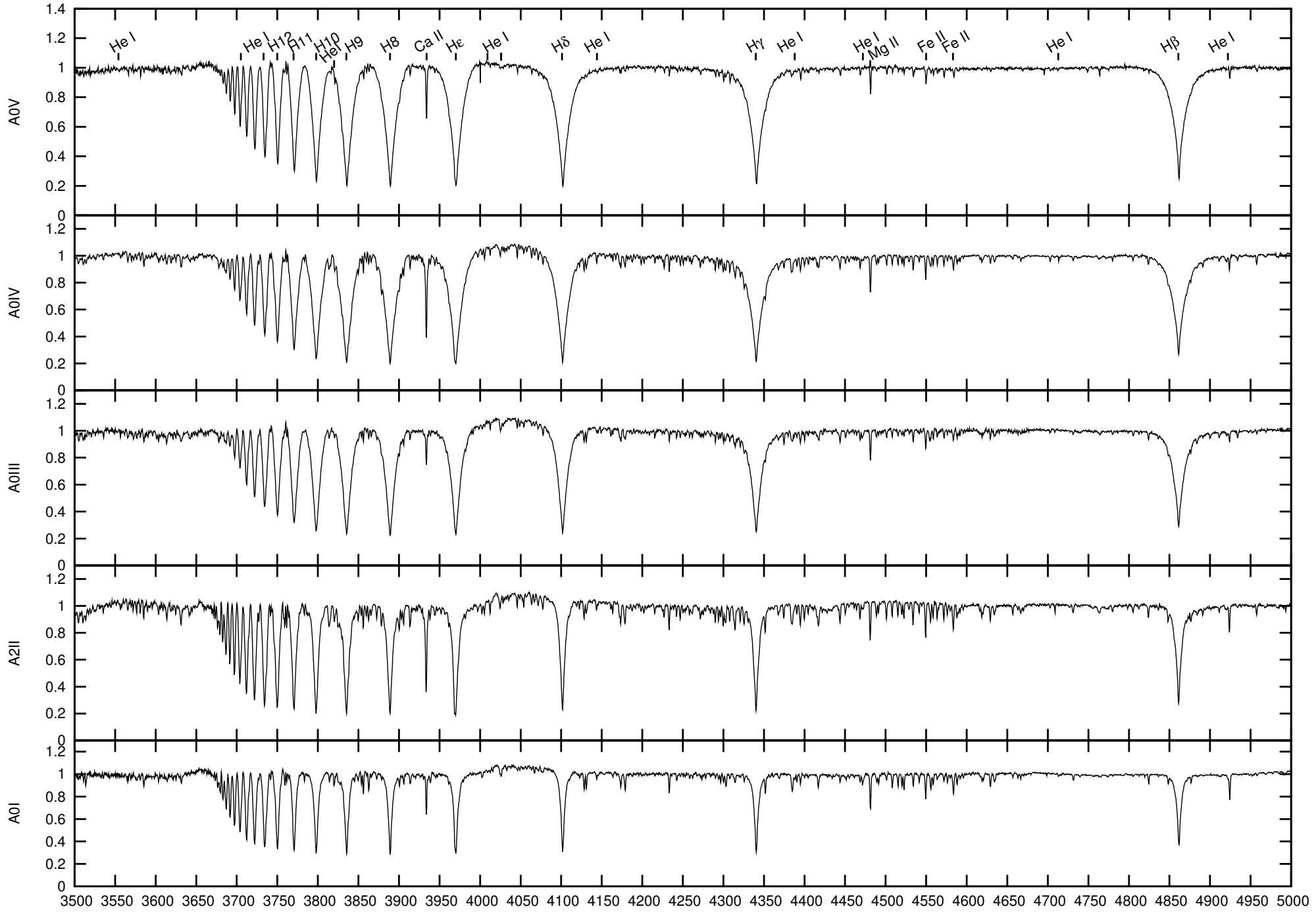
He I
He I
H12
H11
H10
He I
H9
H8
Ca II
Hε
He I
Hδ
He I
Hγ
He I
He I
Mg II
Fe II
Fe II
He I
Hβ
He I
A0V
A0IV
A0III
A2II
A0I
0
0.2
0.4
0.6
0.8
1
1.2
1.4
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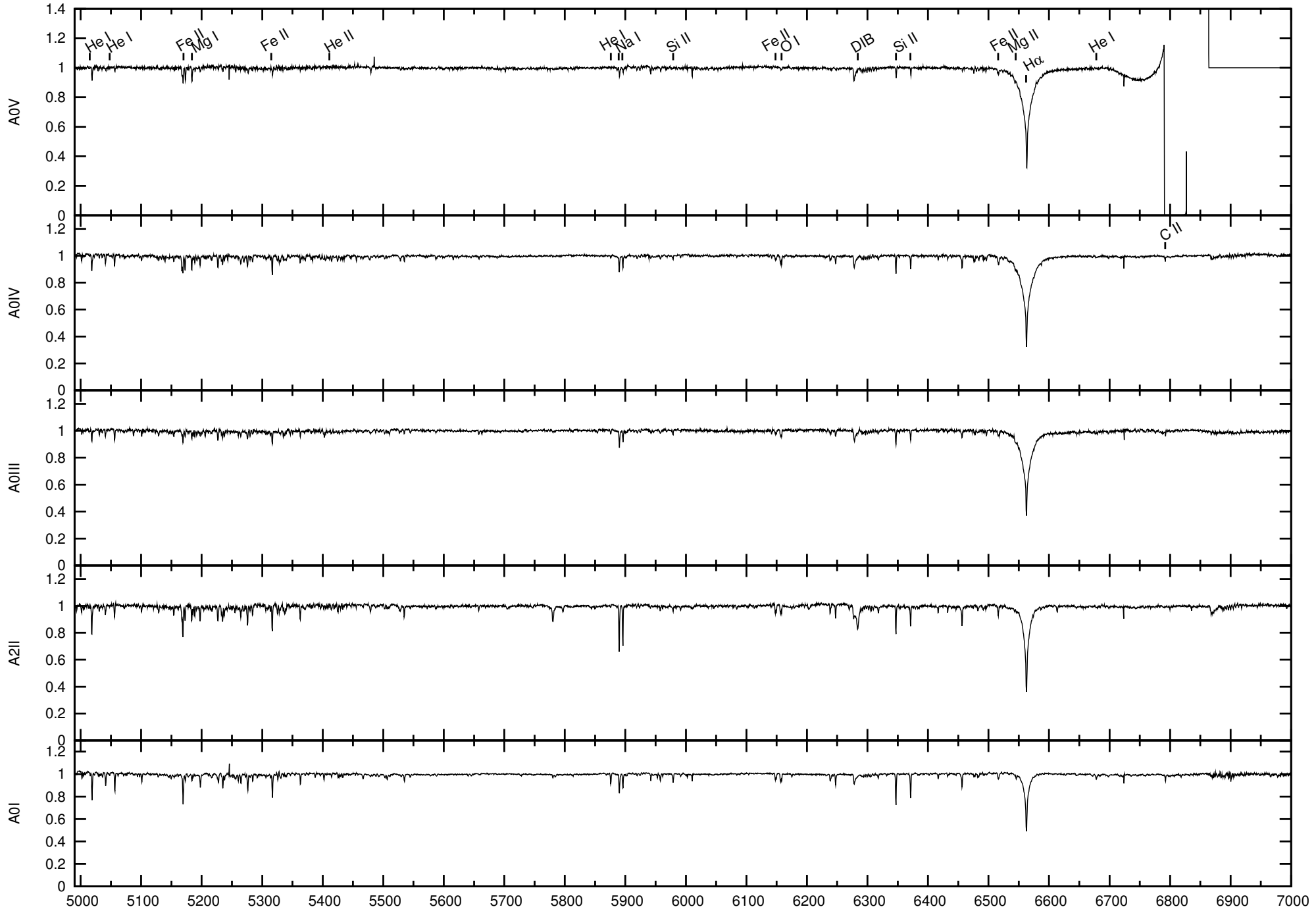
A0V
A0IV
A0III
A2II
A0I
He I
He I
Fe II
Mg I
Fe II
He II
He I
Na I
Si II
Fe II
O I
DIB
Si II
Fe II
Mg II
Hα
He I
C II
5000
5100
5200
5300
5400
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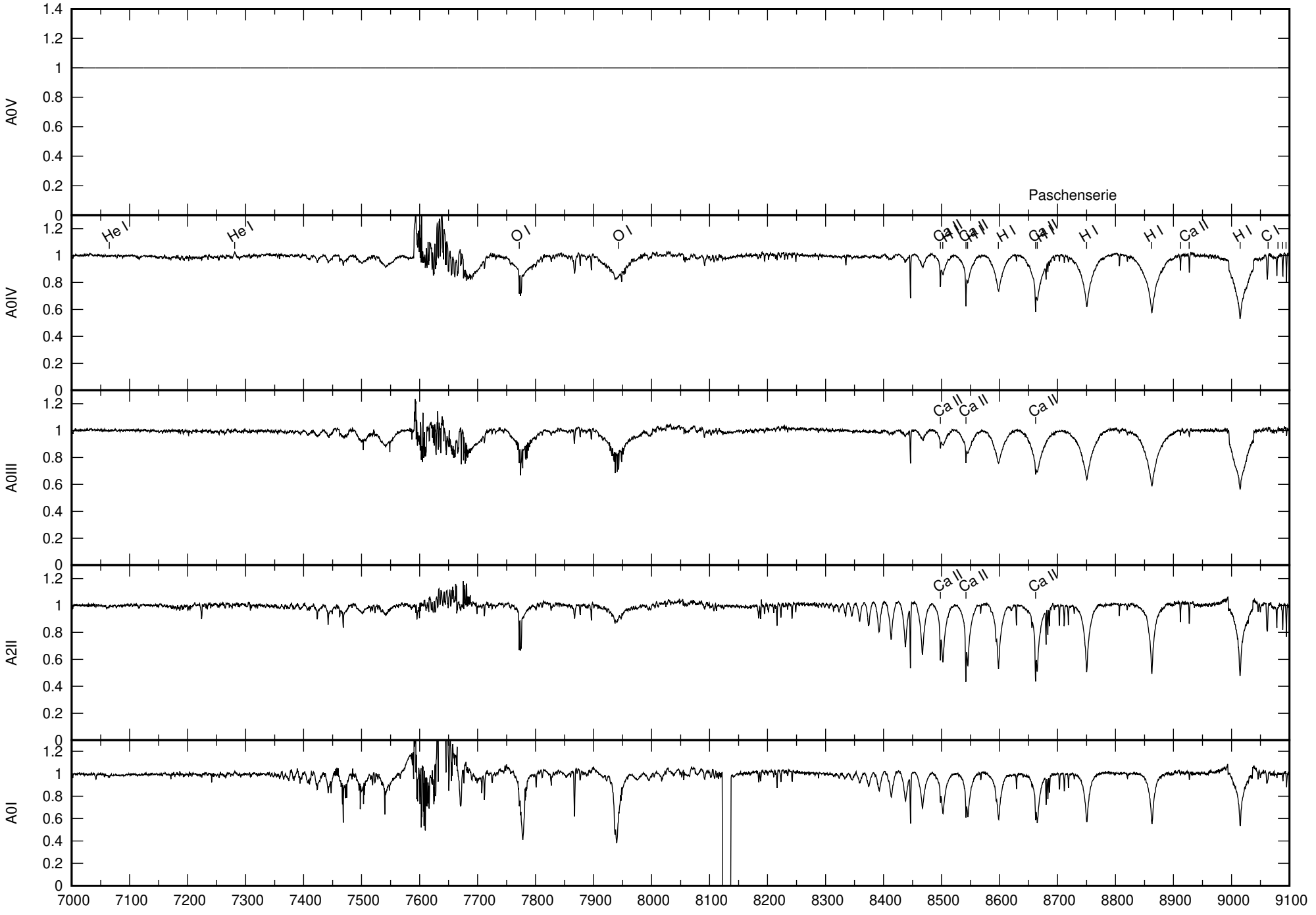
A0V
A0IV
A0III
A2II
A0I
Paschenserie
He I
He I
O I
O I
Ca II
Ca II
Ca II
H I
Ca II
H I
H I
Ca II
H I
C I
Ca II
Ca II
Ca II
Ca II
Ca II
Ca II
7000
7100
7200
7300
7400
7500
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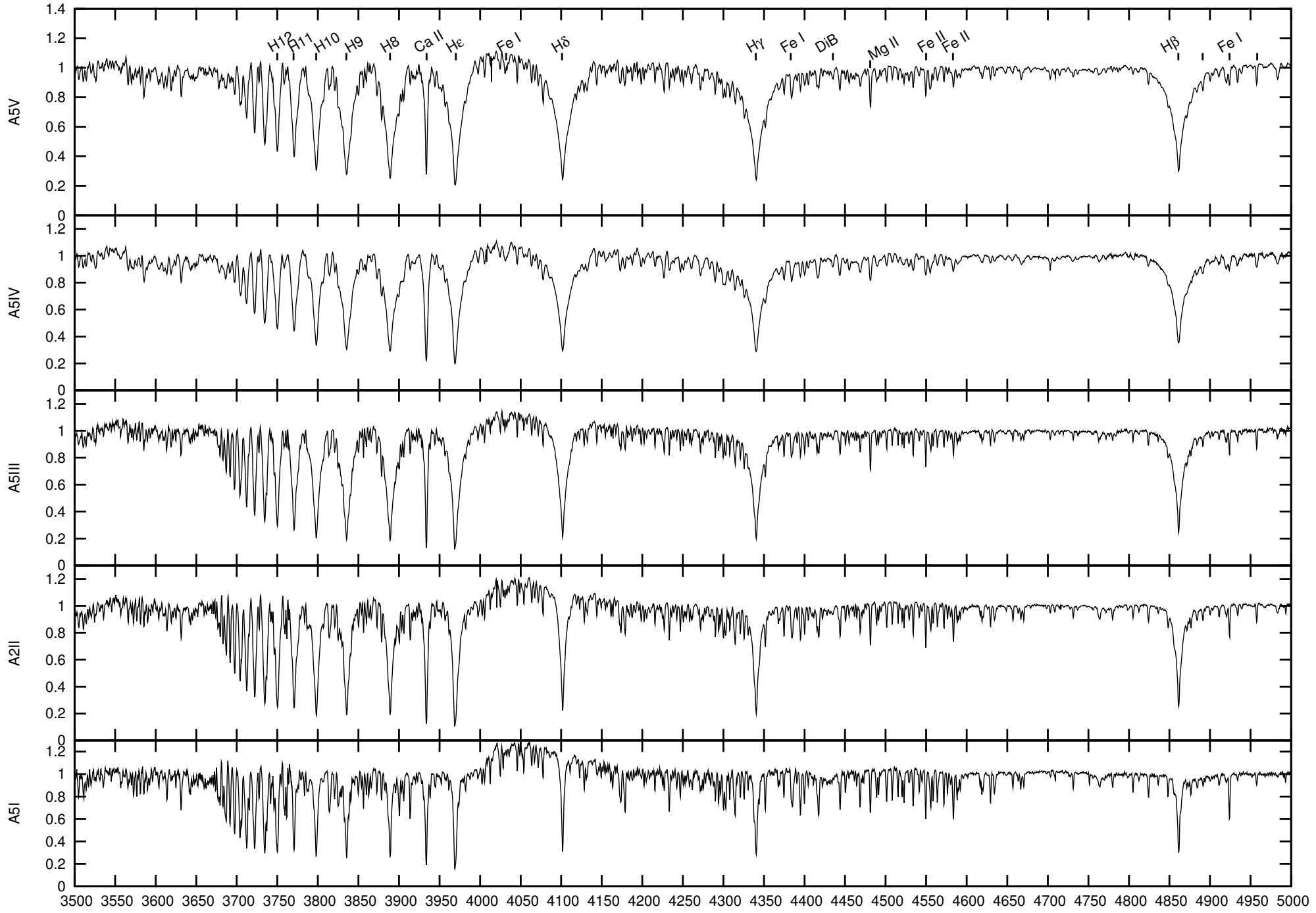
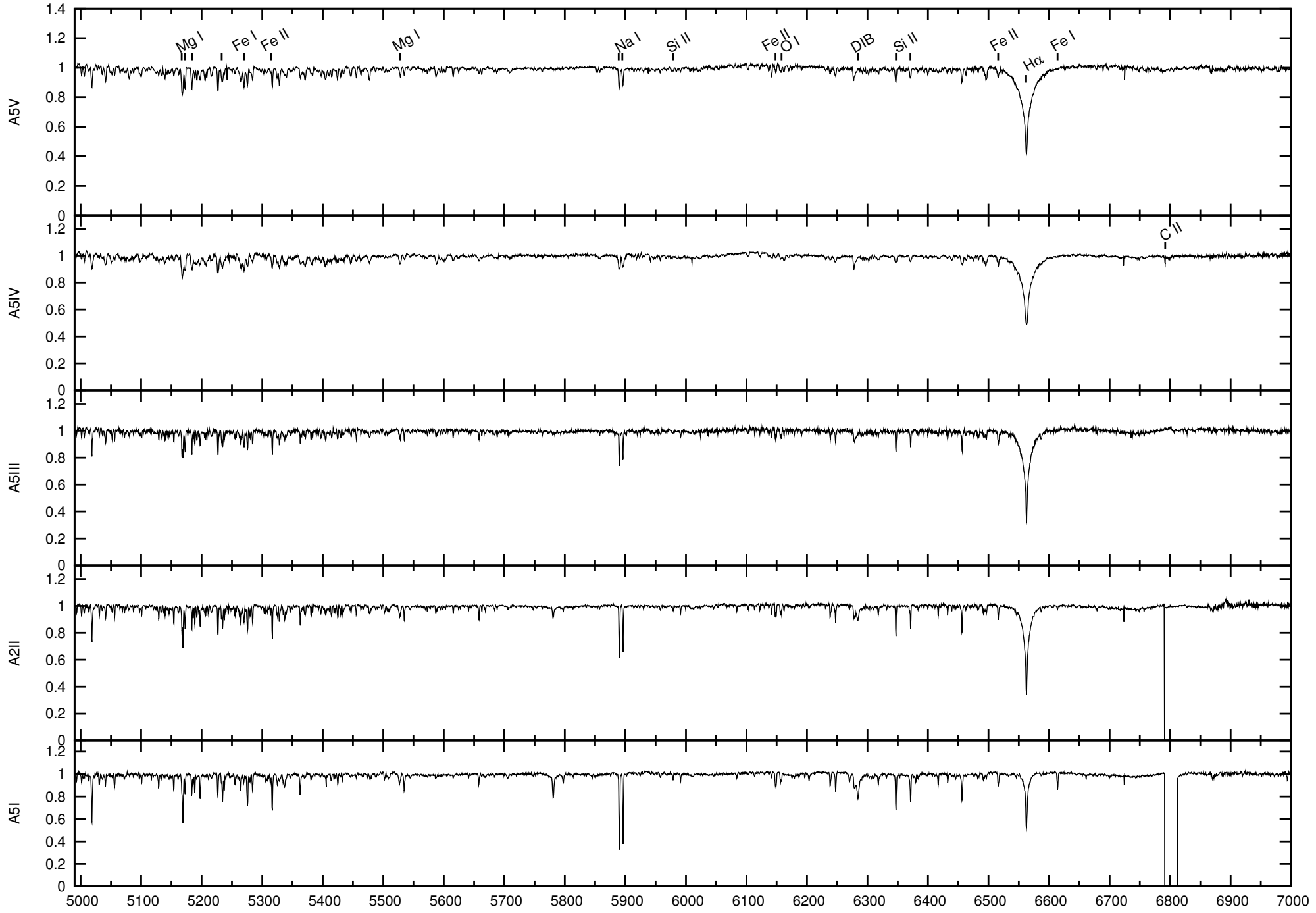

A5V
A5IV
A5III
A2II
A5I
H12
H11
H10
H9
H8
Ca II
Hε
Fe I
Hδ
Hγ
Fe I
DiB
Mg II
Fe II
Fe II
Hβ
Fe I
0
0.2
0.4
0.6
0.8
1
1.2
1.4
3500 3550 3600 3650 3700 3750 3800 3850 3900 3950 4000 4050 4100 4150 4200 4250 4300 4350 4400 4450 4500 4550 4600 4650 4700 4750 4800 4850 4900 4950 5000


A5V
A5IV
A5III
A2II
A5I
Mg I
Fe I
Fe II
Mg I
Na I
Si II
Fe II
O I
DIB
Si II
Fe II
Hα
Fe I
C II
0
0.2
0.4
0.6
0.8
1
1.2
1.4
5000
5100
5200
5300
5400
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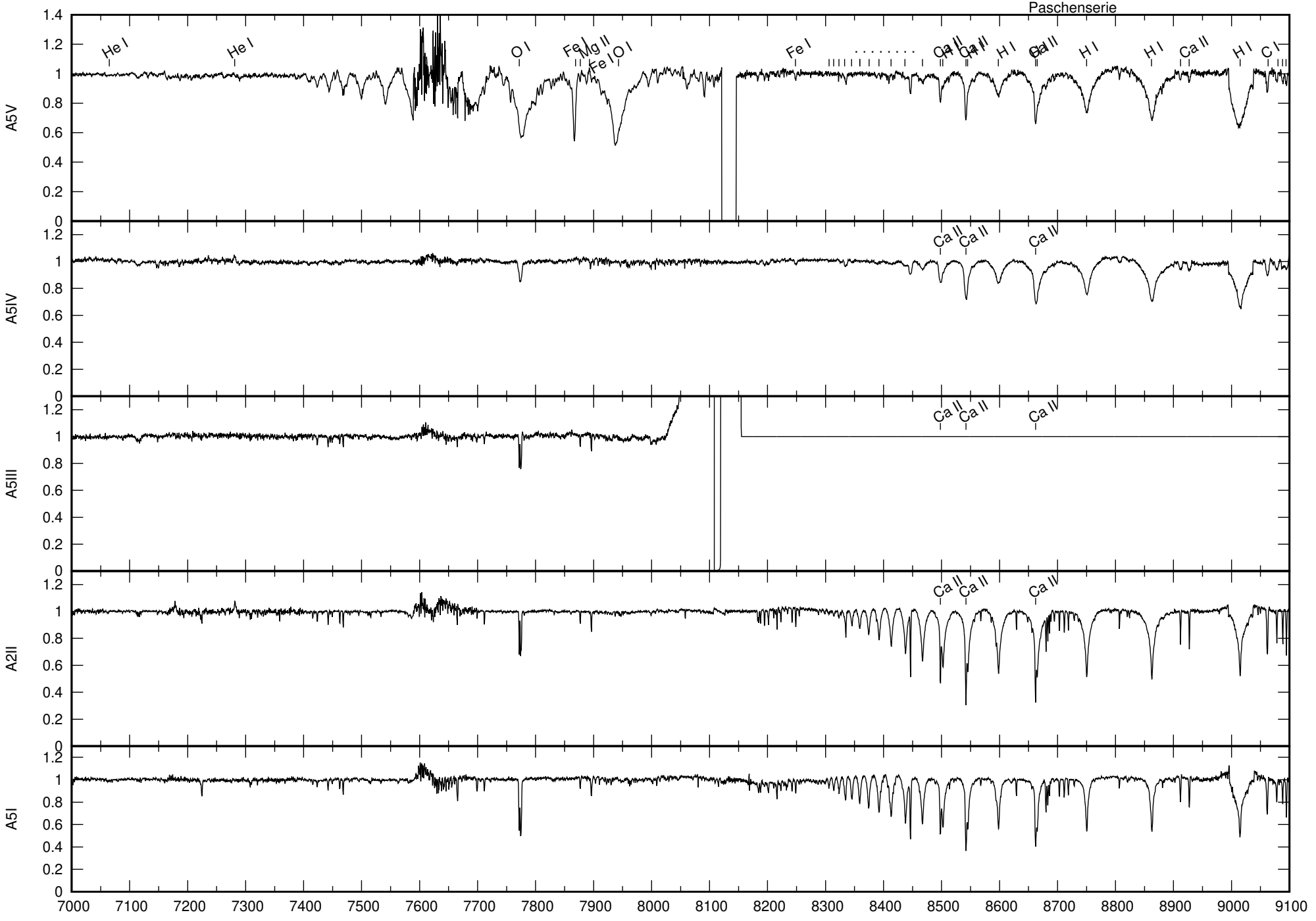
Paschenserie
He I
He I
O I
Fe I
Mg II
Fe I
O I
Fe I
Ca II
Ca II
H I
Ca II
H I
H I
Ca II
H I
C I
Ca II
Ca II
Ca II
A5V
A5IV
A5III
A2II
A5I
0
0.2
0.4
0.6
0.8
1
1.2
1.4
7000
7100
7200
7300
7400
7500
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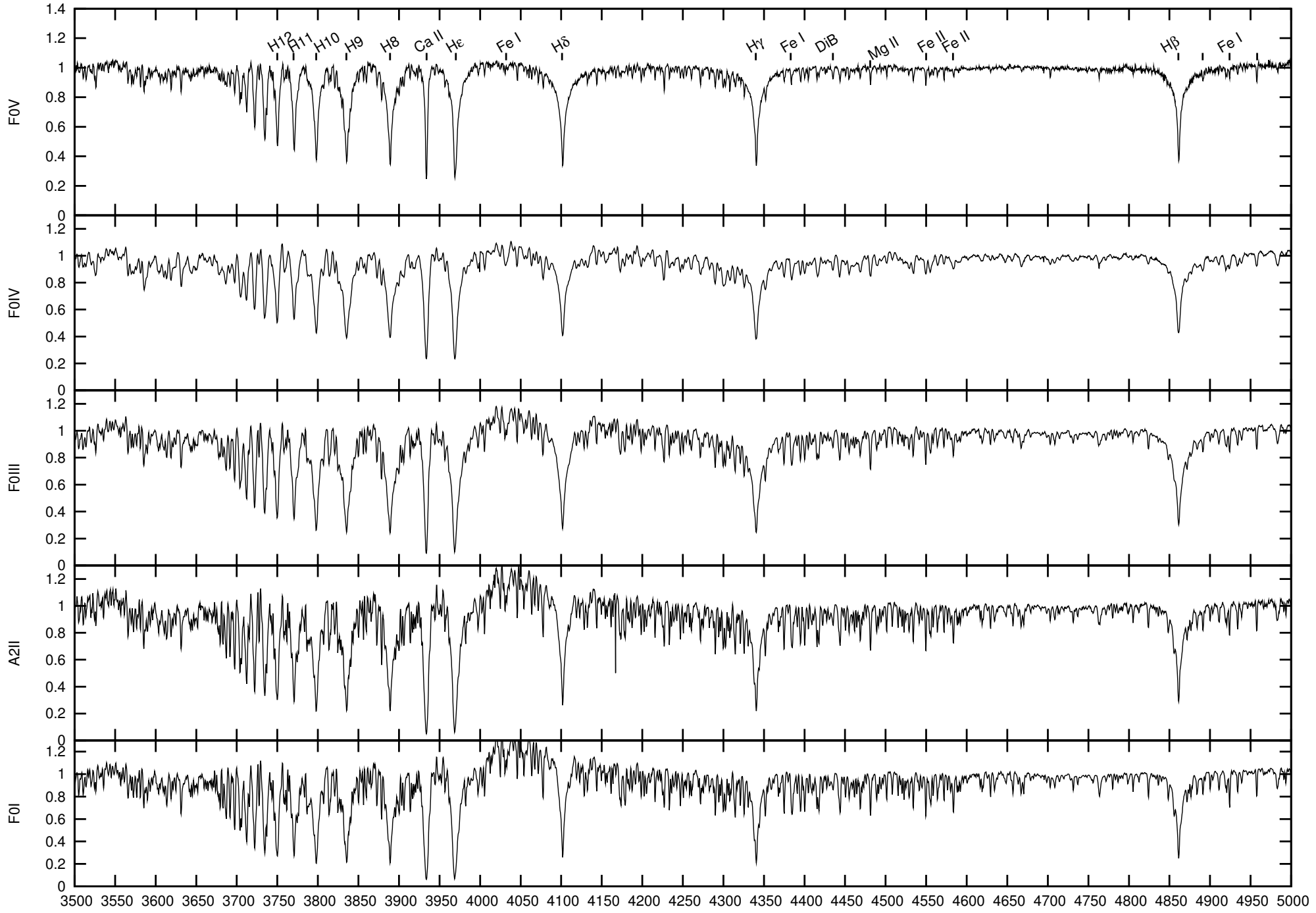
H12
H11
H10
H9
H8
Ca II
Hε
Fe I
Hδ
Hγ
Fe I
DiB
Mg II
Fe II
Fe II
Hβ
Fe I
F0V
F0IV
F0III
A2II
F0I
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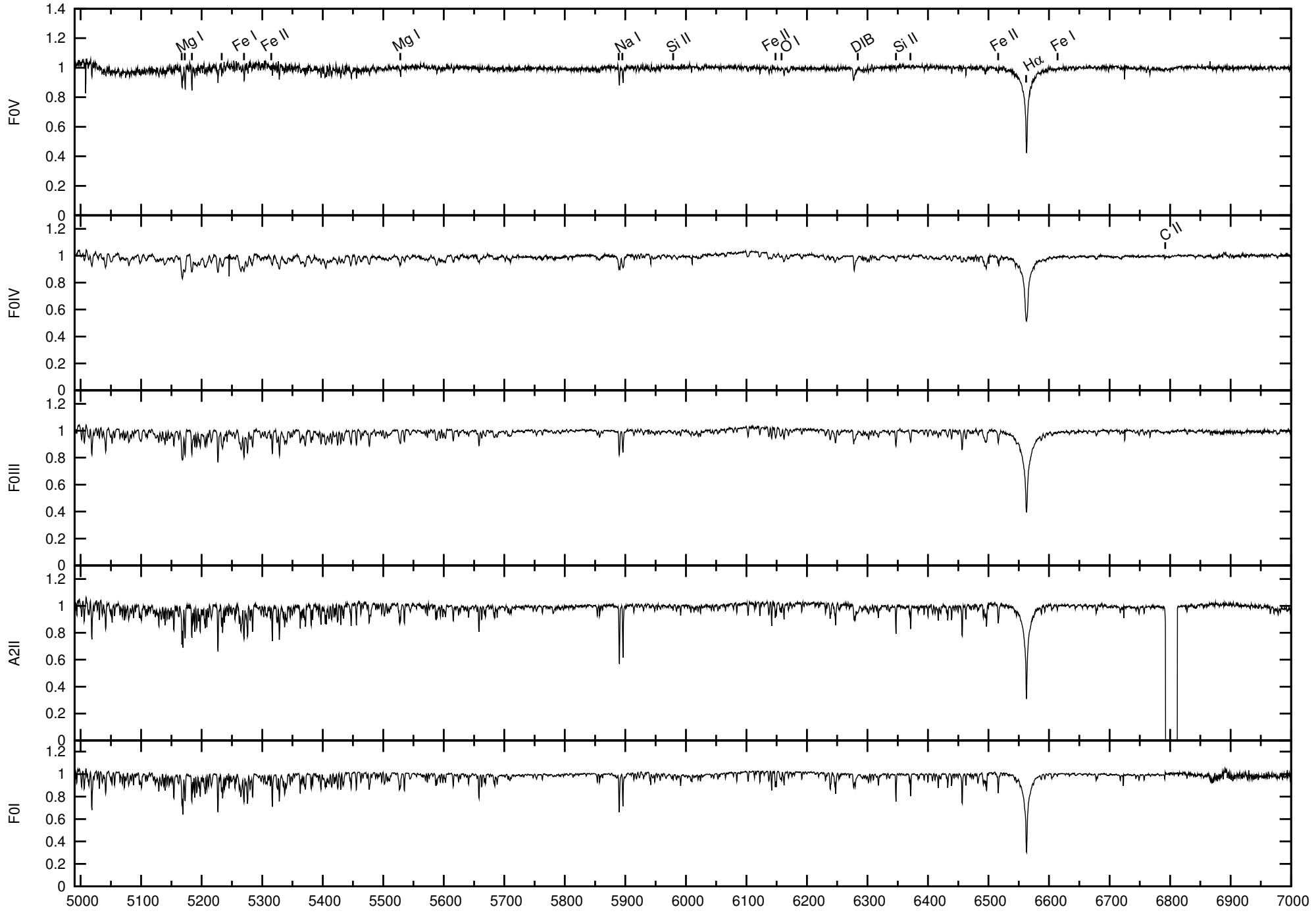
F0V
F0IV
F0III
A2II
F0I
Mg I
Fe I
Fe II
Mg I
Na I
Si II
Fe II
O I
DIB
Si II
Fe II
Hα
Fe I
C II
1.4
1.2
1
0.8
0.6
0.4
0.2
0
5000
5100
5200
5300
5400
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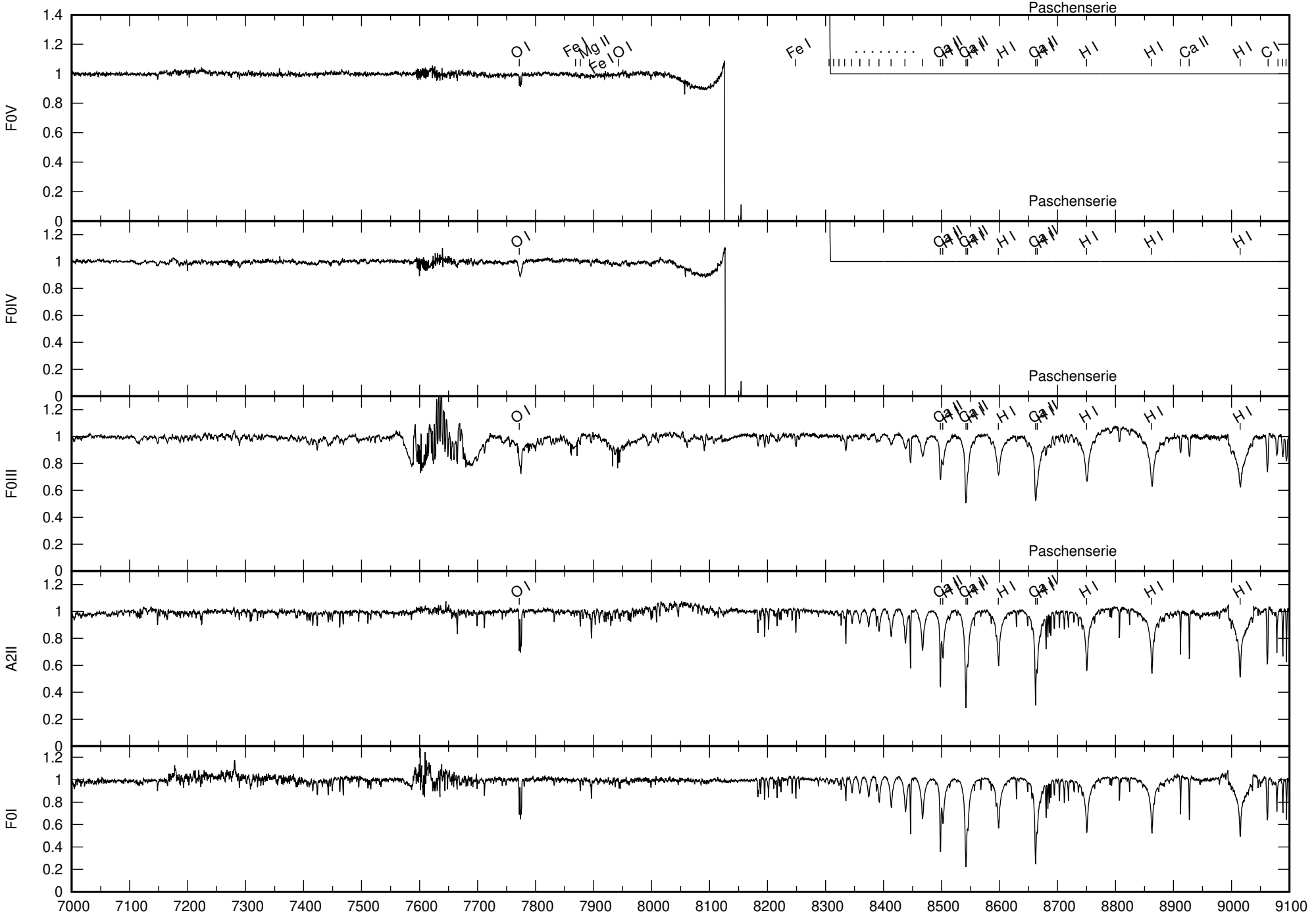
F0V
F0IV
F0III
A2II
F0I
Paschenserie
O I
Fe I
Mg II
Ca II
H I
Cl I
7000
7100
7200
7300
7400
7500
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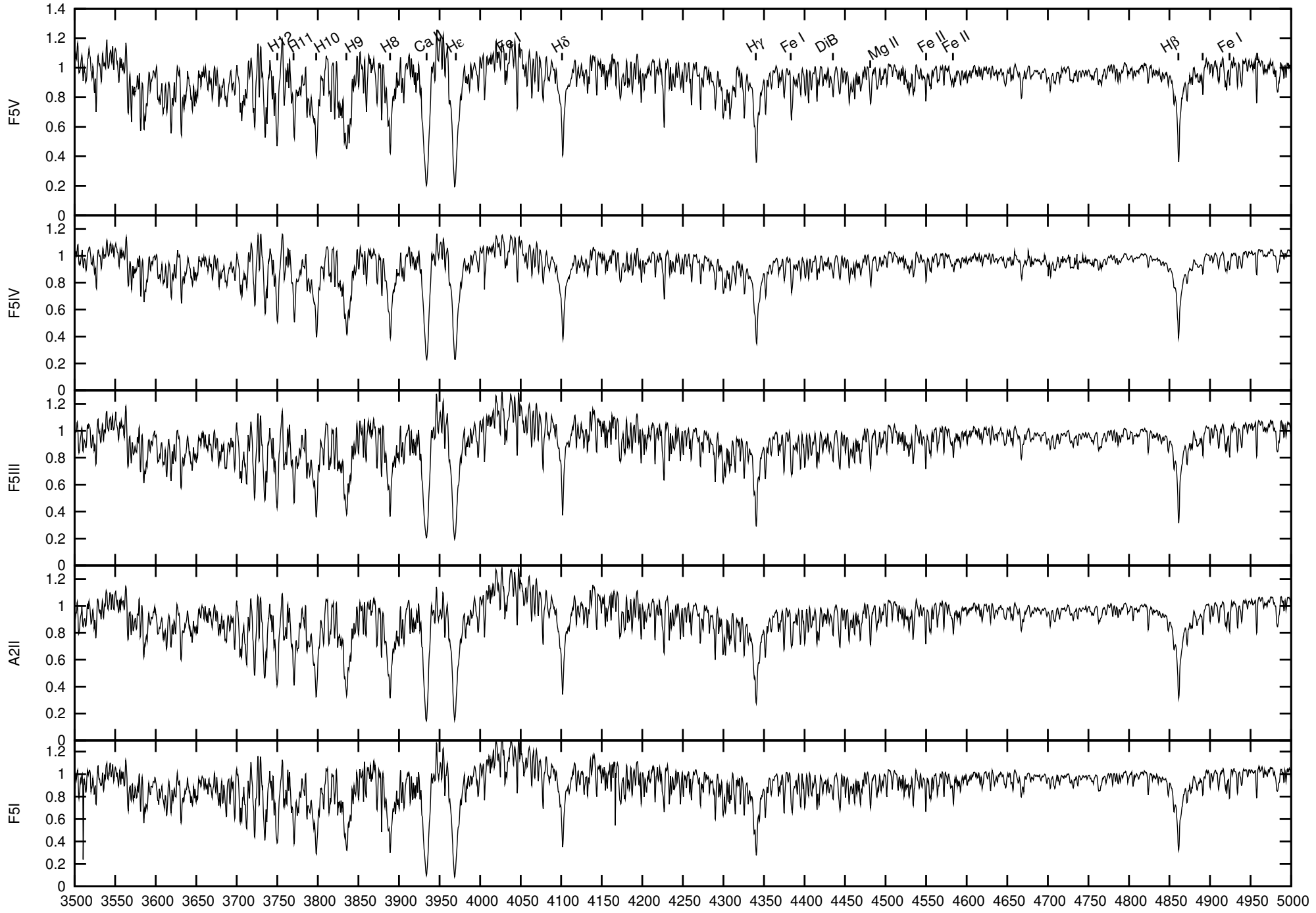
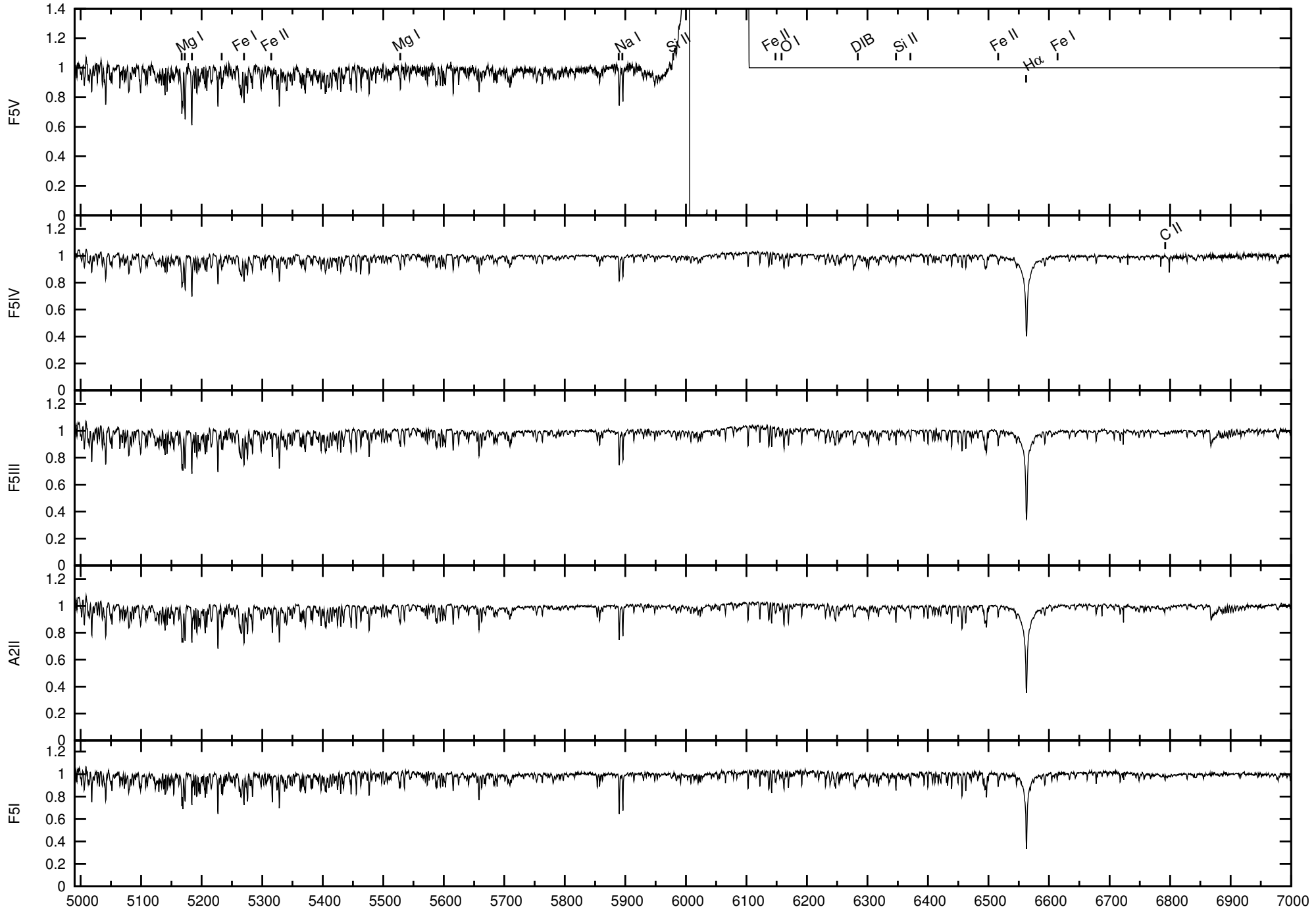

H12
H11
H10
H9
H8
Ca II
Hε
Fe I
Hδ
Hγ
Fe I
DiB
Mg II
Fe II
Fe II
Hβ
Fe I
F5V
F5IV
F5III
A2II
F5I
1.4
1.2
1
0.8
0.6
0.4
0.2
0
3500 3550 3600 3650 3700 3750 3800 3850 3900 3950 4000 4050 4100 4150 4200 4250 4300 4350 4400 4450 4500 4550 4600 4650 4700 4750 4800 4850 4900 4950 5000


F5V
F5IV
F5III
A2II
F5I
Mg I
Fe I
Fe II
Mg I
Na I
Si II
Fe II
O I
DIB
Si II
Fe II
Hα
Fe I
C II
1.4
1.2
1
0.8
0.6
0.4
0.2
0
5000
5100
5200
5300
5400
5500
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6000
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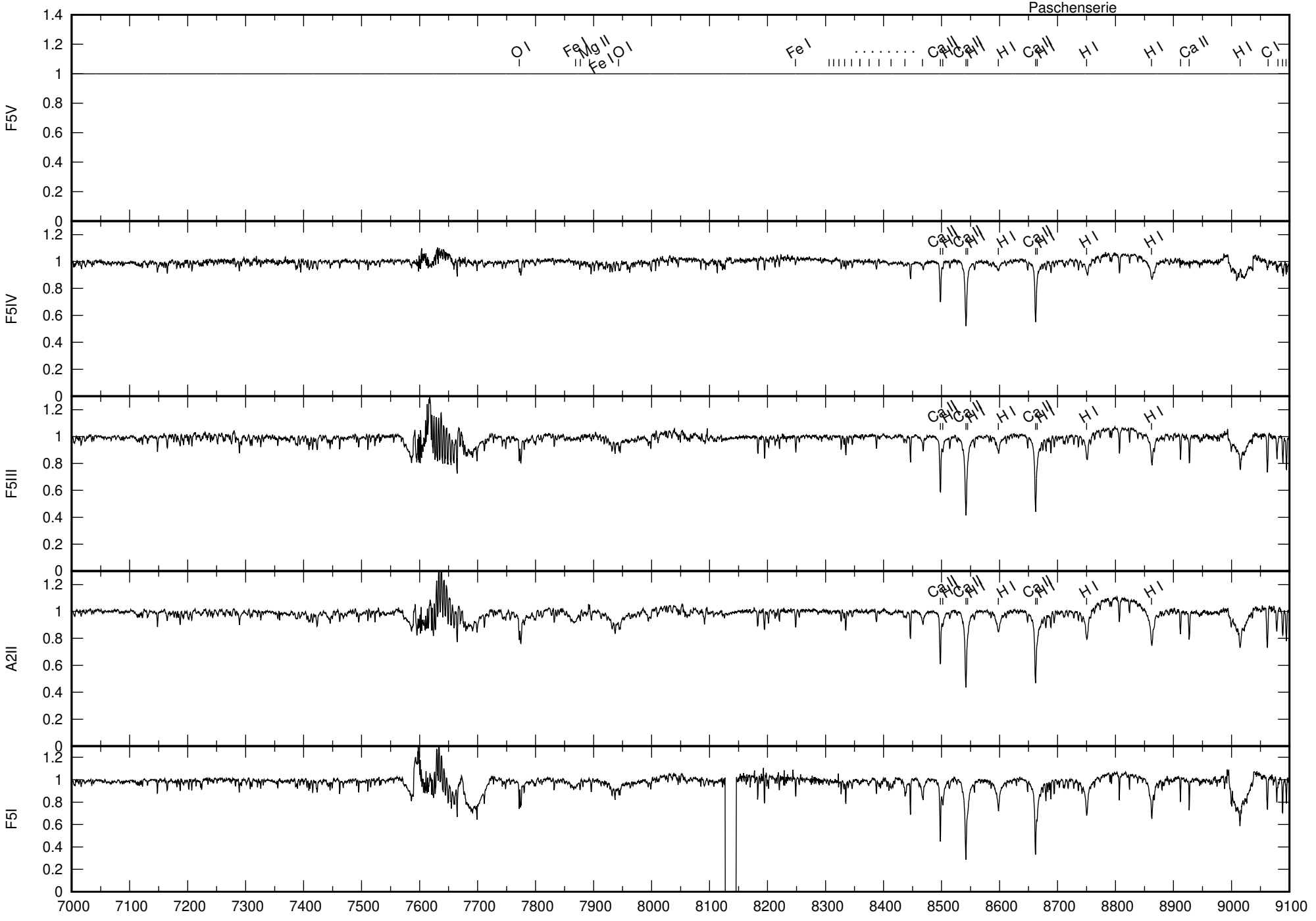
Paschenserie
O I
Fe I
Mg II
Fe I
O I
Fe I
Ca II
H I
H I
Ca II
H I
H I
Ca II
H I
C I
F5V
F5IV
F5III
A2II
F5I
7000
7100
7200
7300
7400
7500
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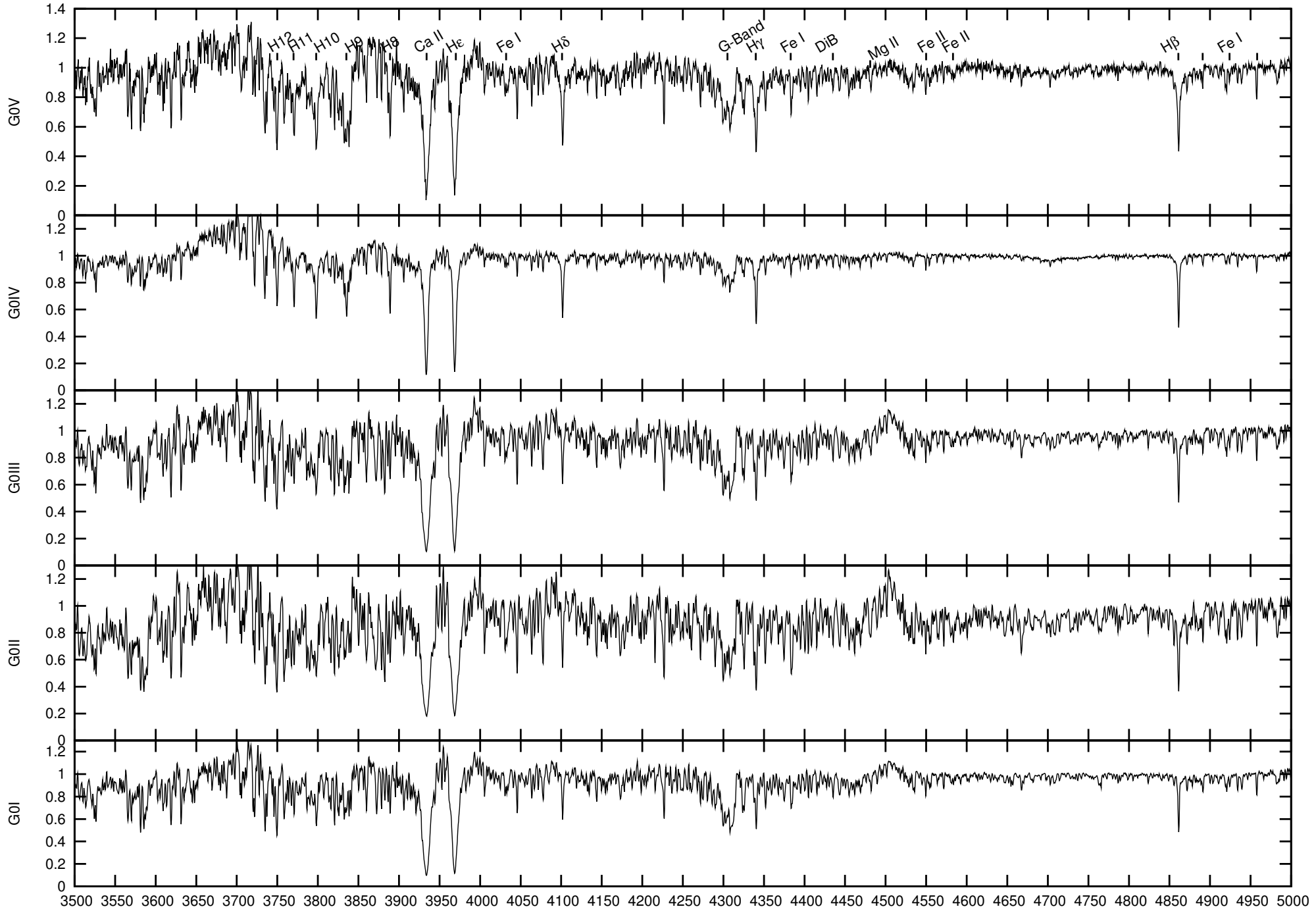
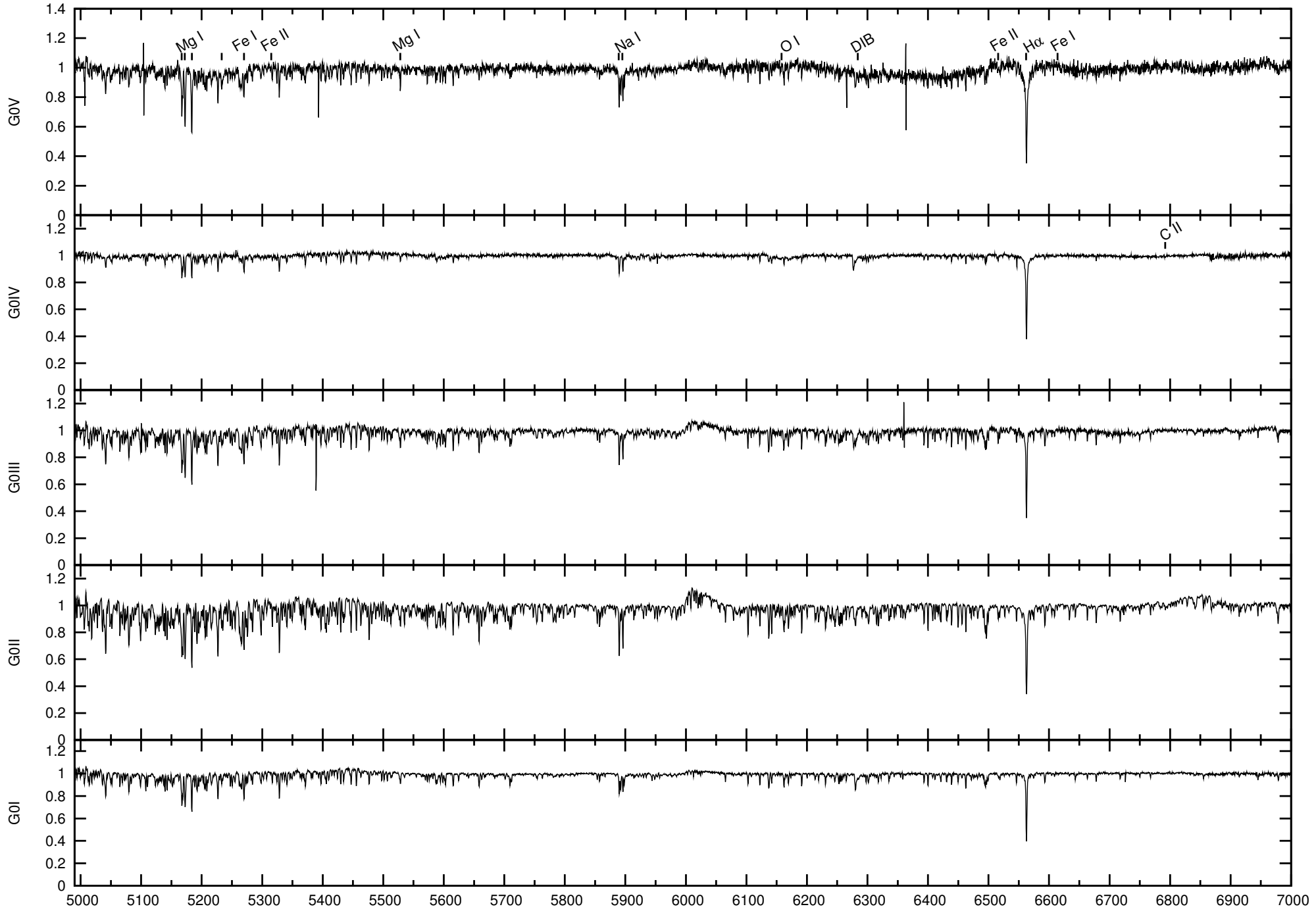

G0V
G0IV
G0III
G0II
G0I
H12
H11
H10
Hθ
Hη
Ca II
Hε
Fe I
Hδ
G-Band
Hγ
Fe I
DiB
Mg II
Fe II
Fe II
Hβ
Fe I
0
0.2
0.4
0.6
0.8
1
1.2
1.4
3500 3550 3600 3650 3700 3750 3800 3850 3900 3950 4000 4050 4100 4150 4200 4250 4300 4350 4400 4450 4500 4550 4600 4650 4700 4750 4800 4850 4900 4950 5000


G0V
G0IV
G0III
G0II
G0I
Mg I
Fe I
Fe II
Mg I
Na I
O I
DIB
Fe II
Hα
Fe I
C II
5000
5100
5200
5300
5400
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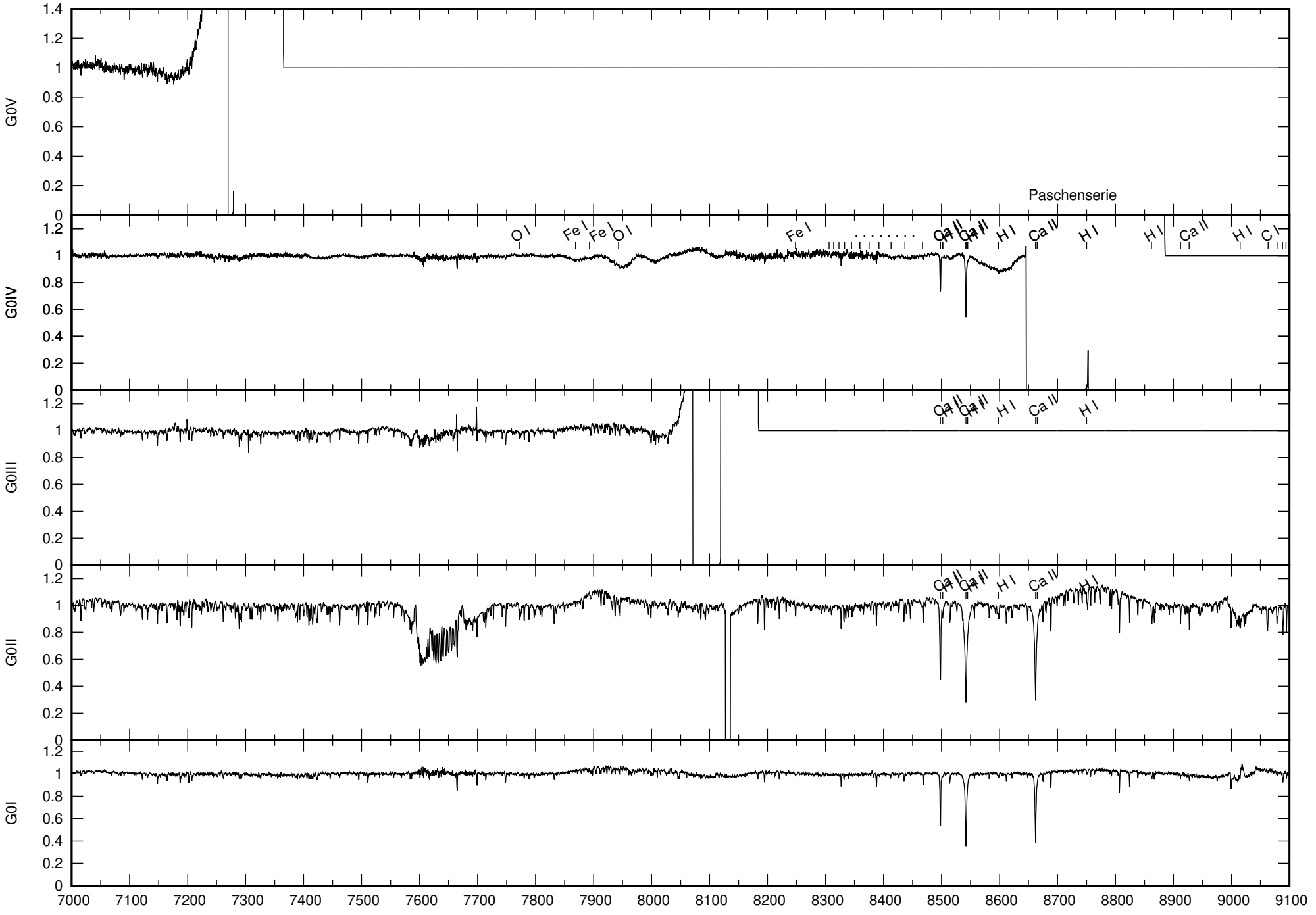
7000


G0V
G0IV
G0III
G0II
G0I
Paschenserie
O I
Fe I
Fe I
O I
Fe I
Ca II
Ca II
H I
Ca II
H I
H I
Ca II
H I
C I
7000
7100
7200
7300
7400
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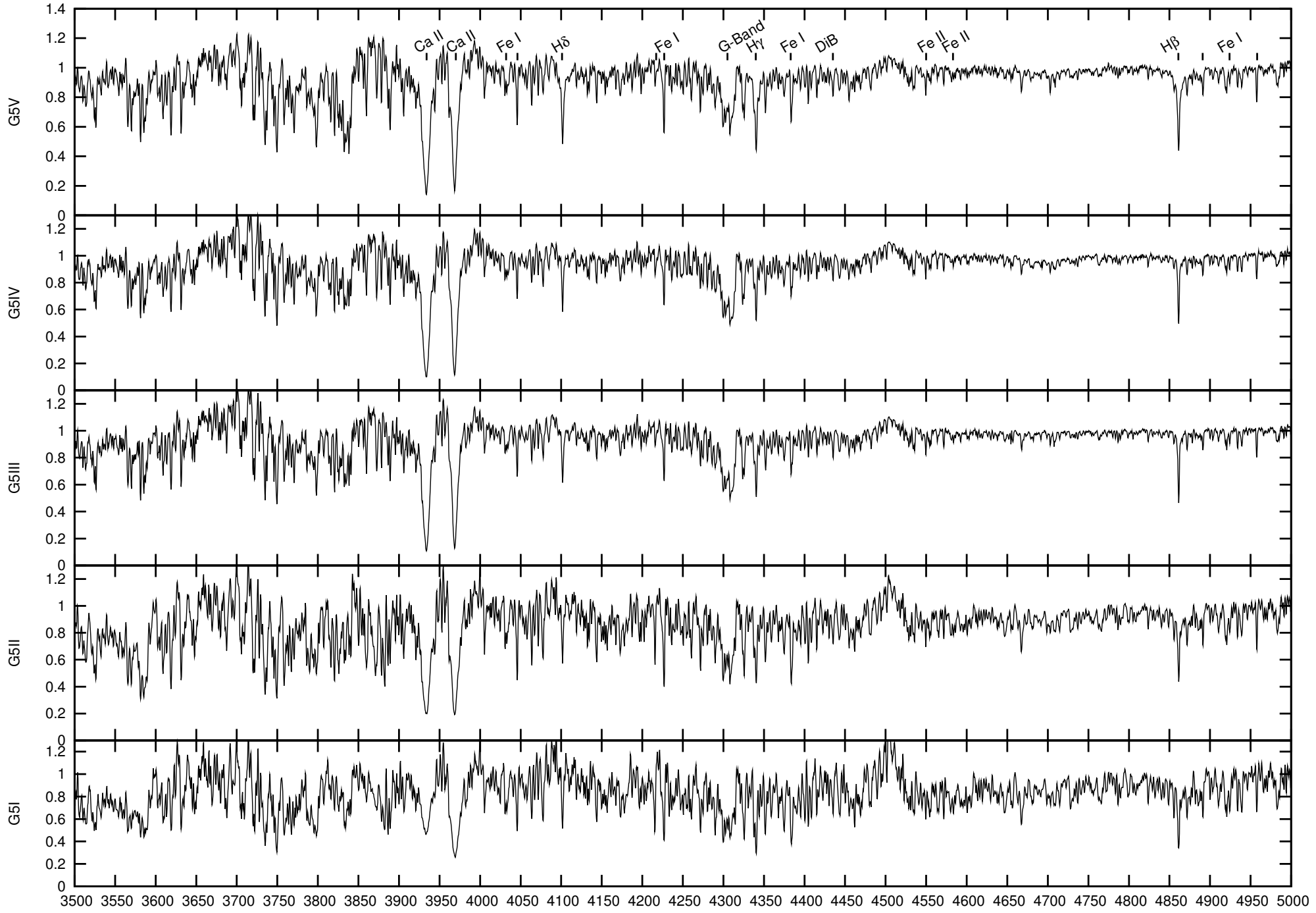
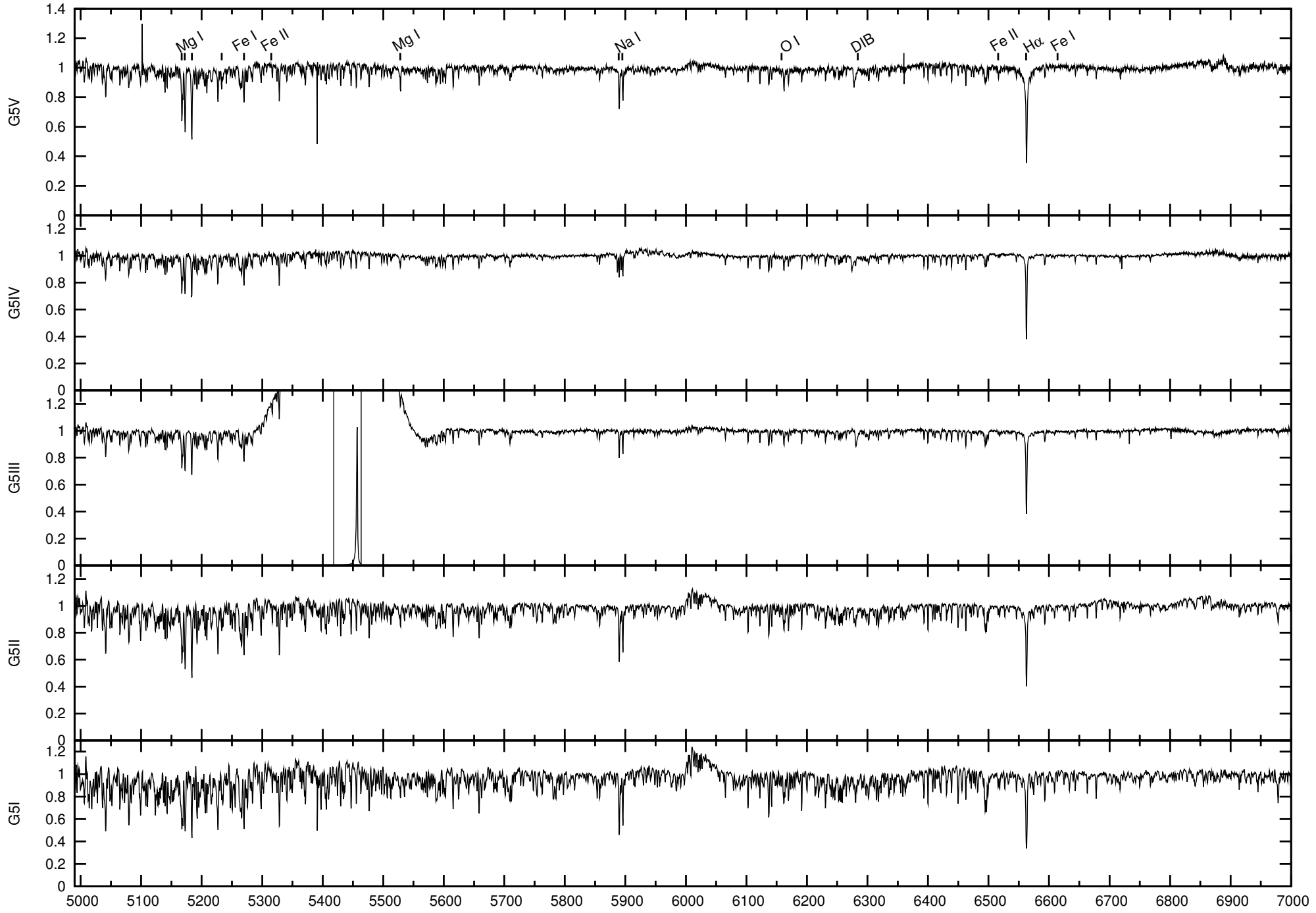
9100


G5V
G5IV
G5III
G5II
G5I
Ca II
Ca II
Fe I
Hδ
Fe I
G-Band
Hγ
Fe I
DiB
Fe II
Fe II
Hβ
Fe I
0
0.2
0.4
0.6
0.8
1
1.2
1.4
3500 3550 3600 3650 3700 3750 3800 3850 3900 3950 4000 4050 4100 4150 4200 4250 4300 4350 4400 4450 4500 4550 4600 4650 4700 4750 4800 4850 4900 4950 5000


G5V
G5IV
G5III
G5II
G5I
Mg I
Fe I
Fe II
Mg I
Na I
O I
DIB
Fe II
Hα
Fe I
0
0.2
0.4
0.6
0.8
1
1.2
1.4
5000
5100
5200
5300
5400
5500
5600
5700
5800
5900
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6100
6200
6300
6400
6500
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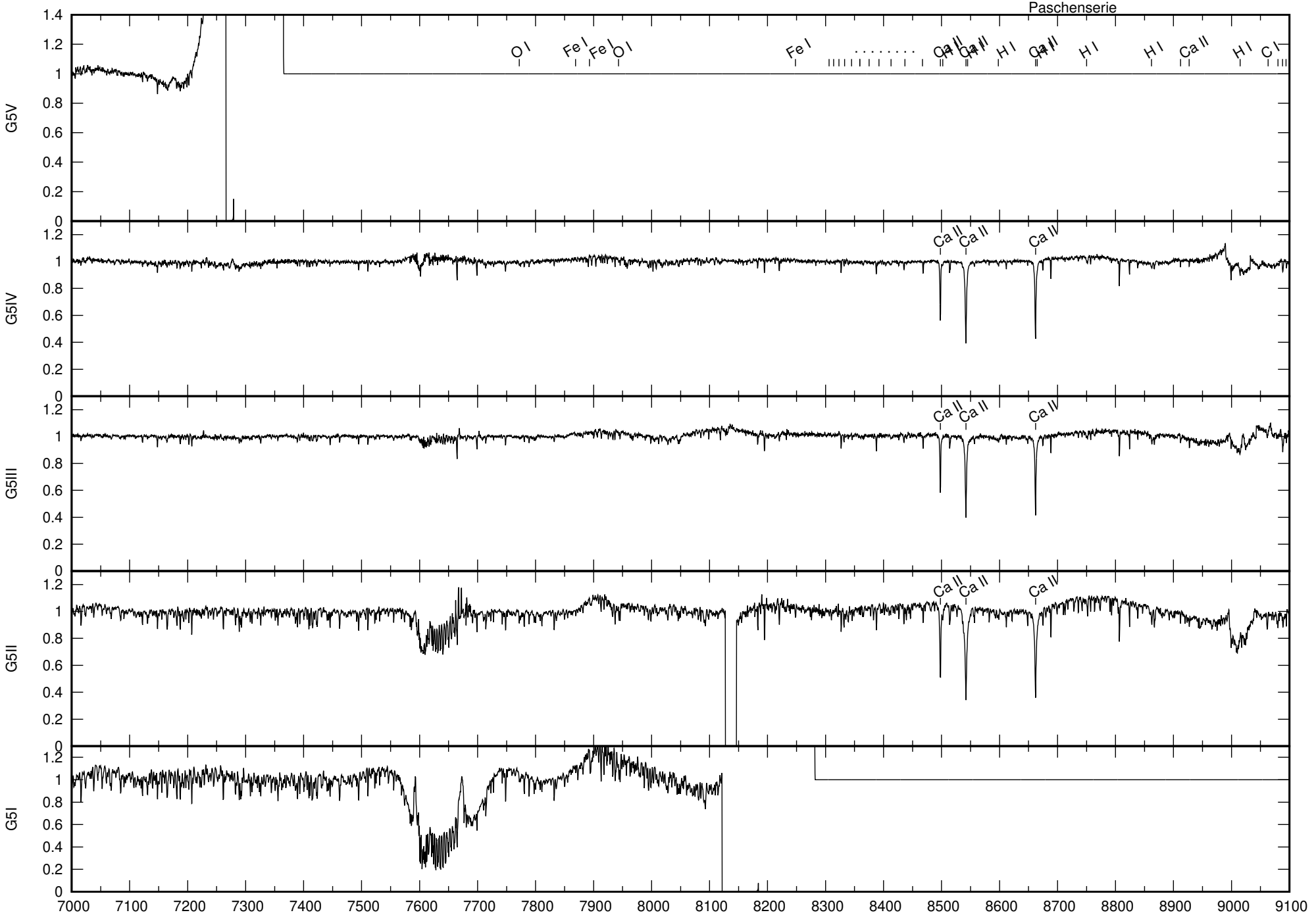
6700
6800
6900
7000


Paschenserie
O I
Fe I
Fe I
Fe I
O I
Fe I
Ca II
Ca II
Ca II
H I
Ca II
H I
H I
Ca II
H I
C I
Ca II
Ca II
Ca II
G5V
G5IV
G5III
G5II
G5I
0
0.2
0.4
0.6
0.8
1
1.2
1.4
7000
7100
7200
7300
7400
7500
7600
7700
7800
7900
8000
8100
8200
8300
8400
8500
8600
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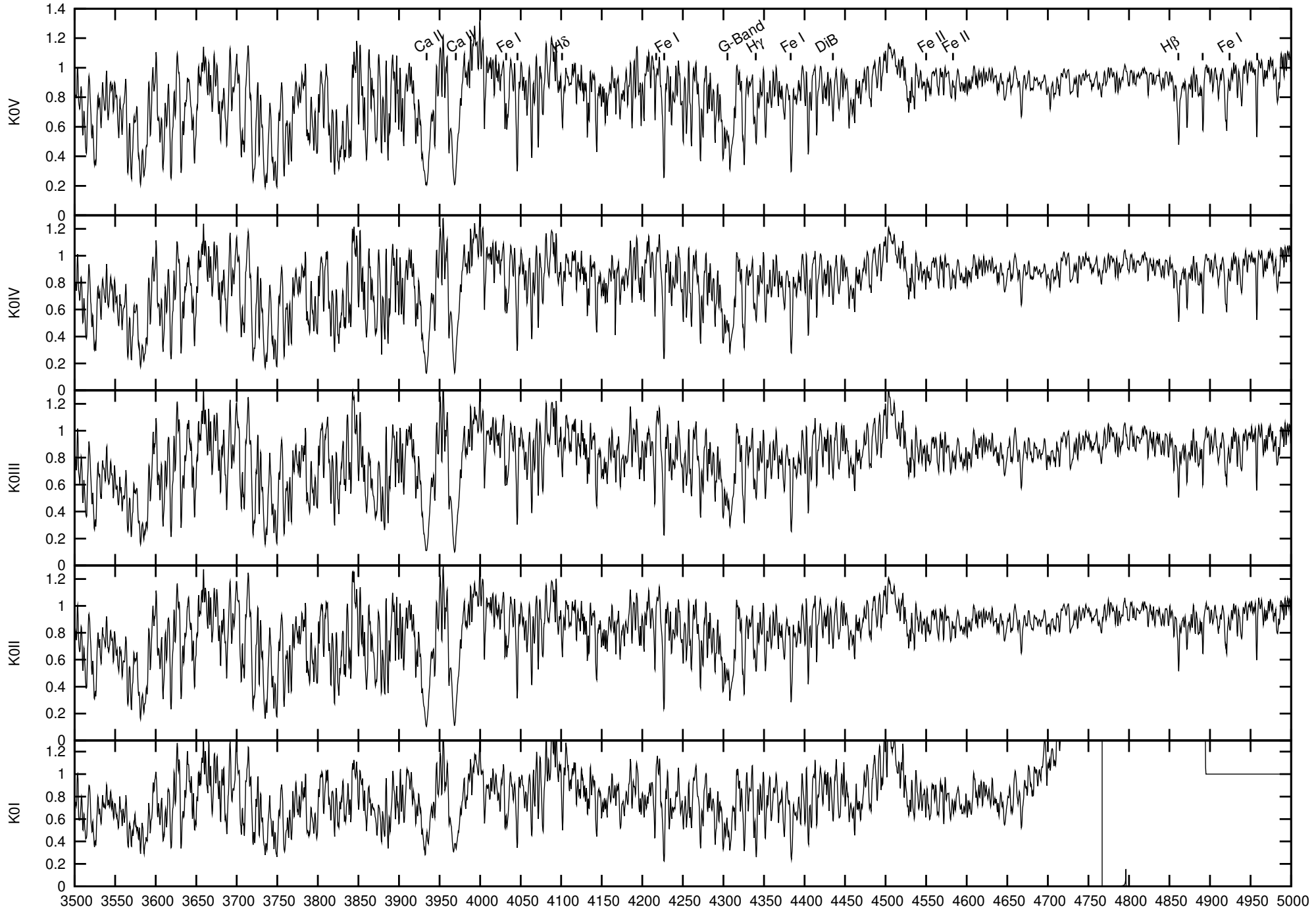
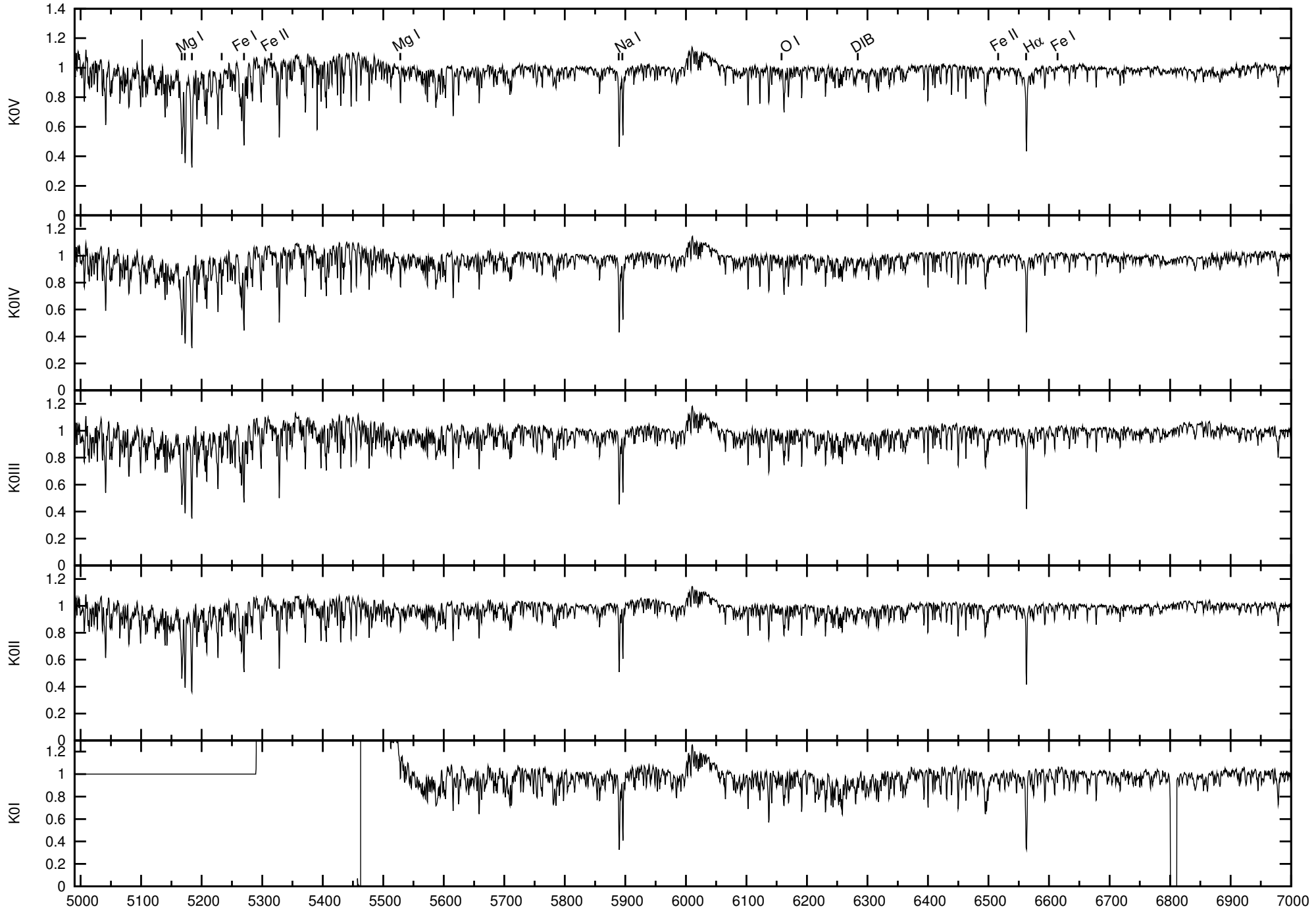
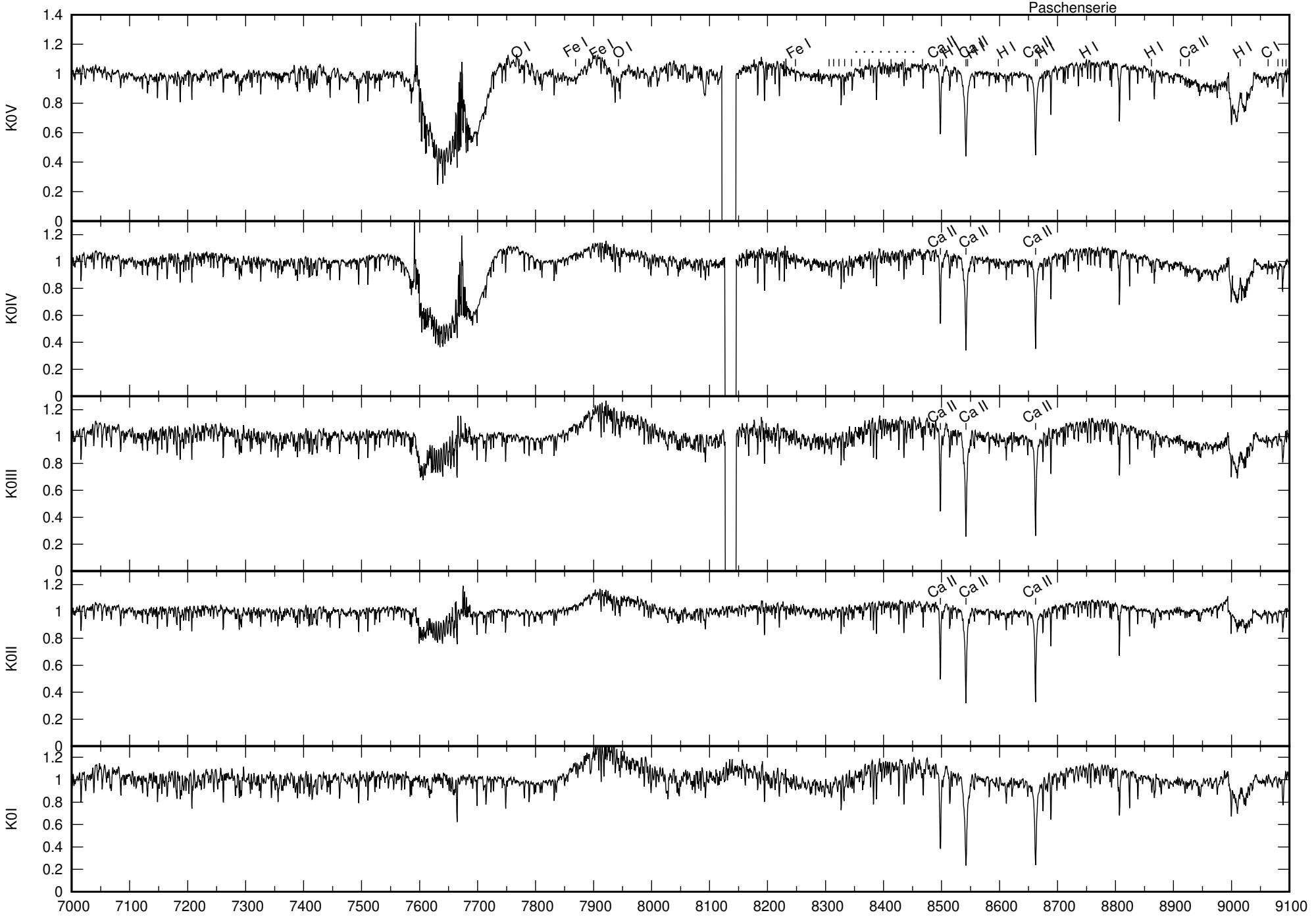
8800
8900
9000
9100


K0V
K0IV
K0III
K0II
K0I
Ca II
Ca II
Fe I
Hδ
Fe I
G-Band
Hγ
Fe I
DiB
Fe II
Fe II
Hβ
Fe I
0
0.2
0.4
0.6
0.8
1
1.2
1.4
3500 3550 3600 3650 3700 3750 3800 3850 3900 3950 4000 4050 4100 4150 4200 4250 4300 4350 4400 4450 4500 4550 4600 4650 4700 4750 4800 4850 4900 4950 5000


Mg I
Fe I
Fe II
Mg I
Na I
O I
DIB
Fe II
Hα
Fe I
K0V
K0IV
K0III
K0II
K0I
5000
5100
5200
5300
5400
5500
5600
5700
5800
5900
6000
6100
6200
6300
6400
6500
6600
6700
6800
6900
7000


Paschenserie
K0V
K0IV
K0III
K0II
K0I
O I
Fe I
Fe I
Fe I
O I
Fe I
Ca II
H I
Ca II
H I
Ca II
H I
H I
H I
Ca II
H I
C I
Ca II
Ca II
Ca II
Ca II
Ca II
Ca II
Ca II
Ca II
Ca II
0
0.2
0.4
0.6
0.8
1
1.2
1.4
7000
7100
7200
7300
7400
7500
7600
7700
7800
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8000
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8200
8300
8400
8500
8600
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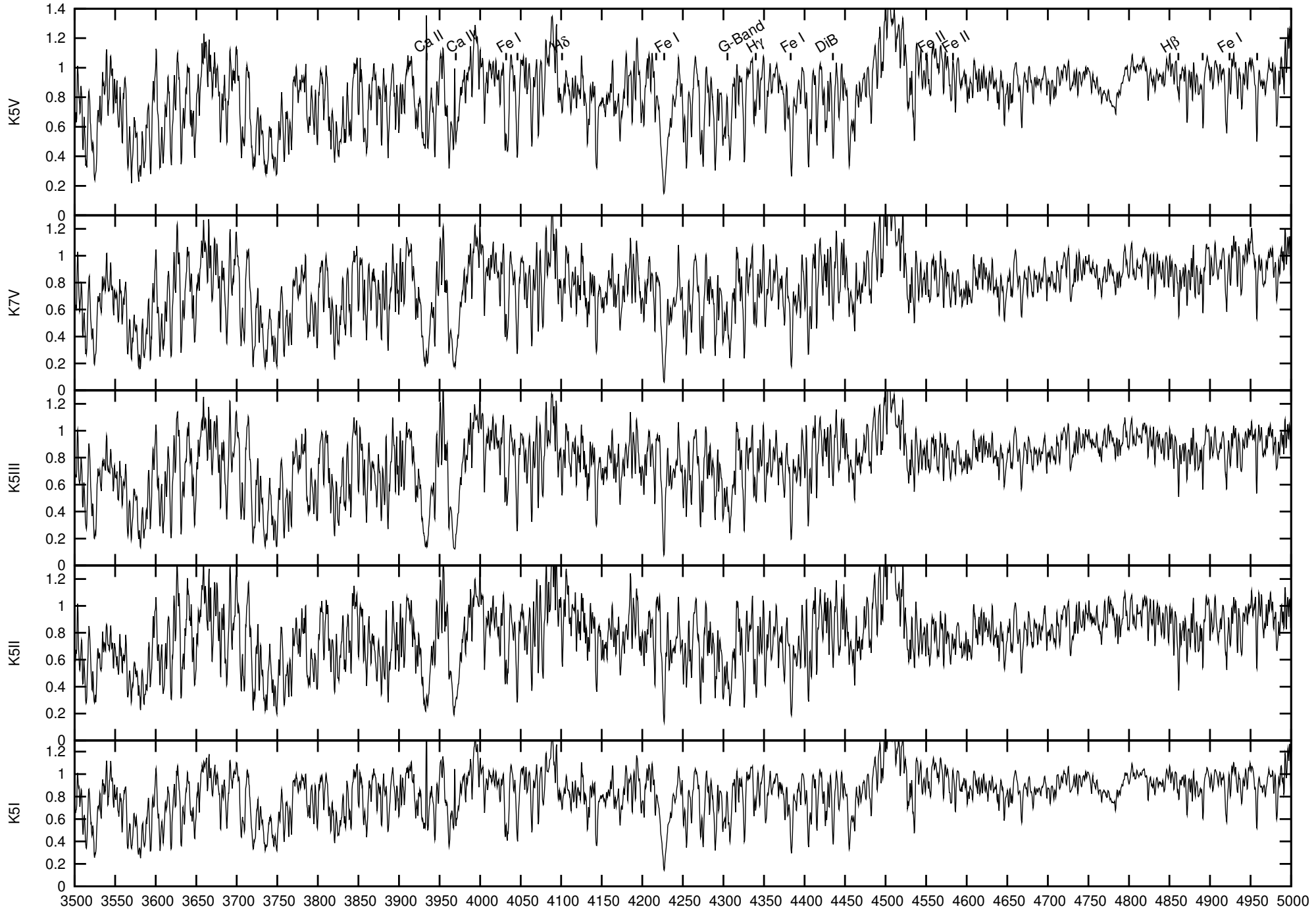
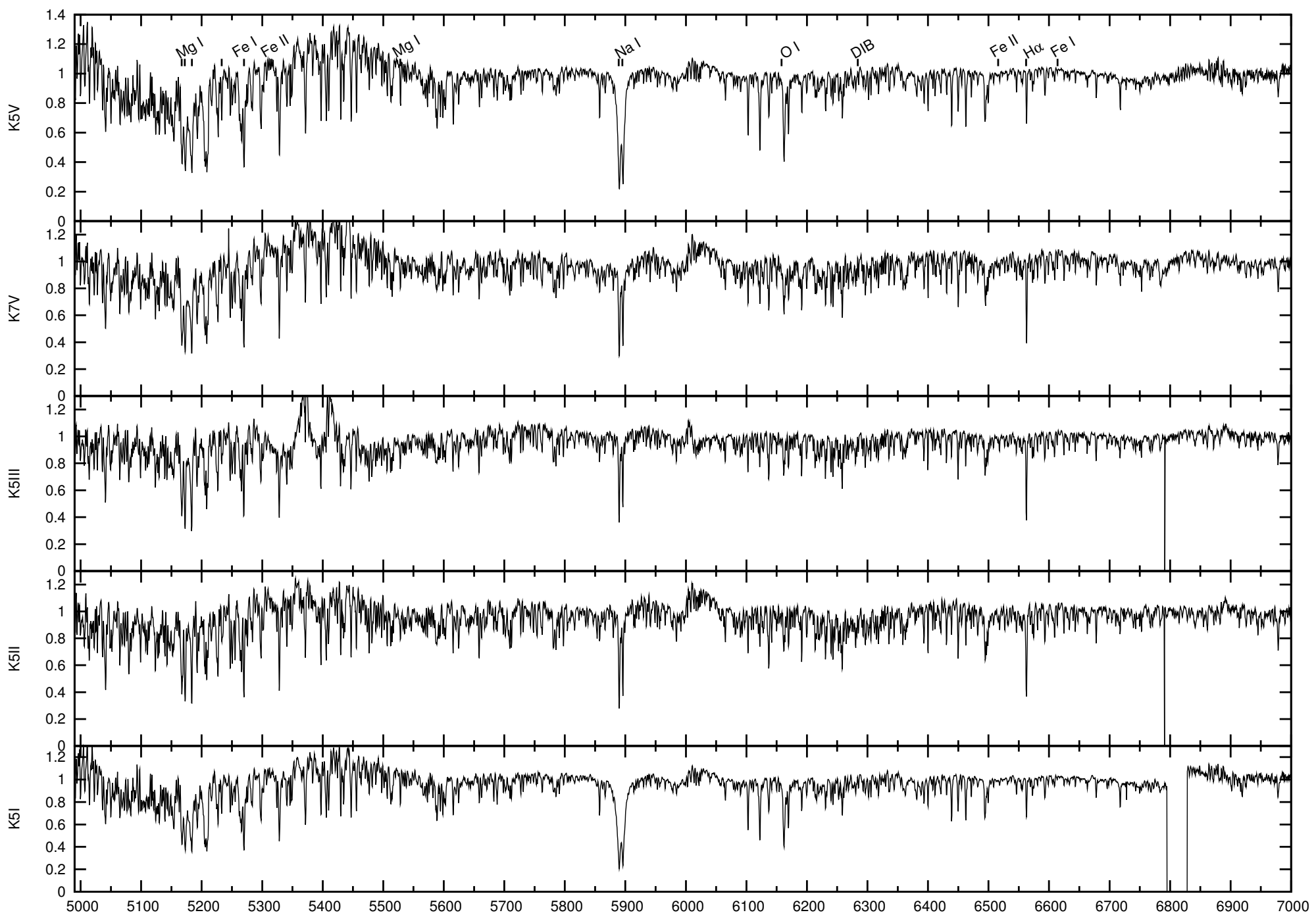
9100


K5V
K7V
K5III
K5II
K5I
Ca II
Ca II
Fe I
Hδ
Fe I
G-Band
Hγ
Fe I
DiB
Fe II
Fe II
Hβ
Fe I
0
0.2
0.4
0.6
0.8
1
1.2
1.4
3500 3550 3600 3650 3700 3750 3800 3850 3900 3950 4000 4050 4100 4150 4200 4250 4300 4350 4400 4450 4500 4550 4600 4650 4700 4750 4800 4850 4900 4950 5000


K5V
K7V
K5III
K5II
K5I
Mg I
Fe I
Fe II
Mg I
Na I
O I
DIB
Fe II
Hα
Fe I
0
0.2
0.4
0.6
0.8
1
1.2
1.4
5000
5100
5200
5300
5400
5500
5600
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5900
6000
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6200
6300
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6500
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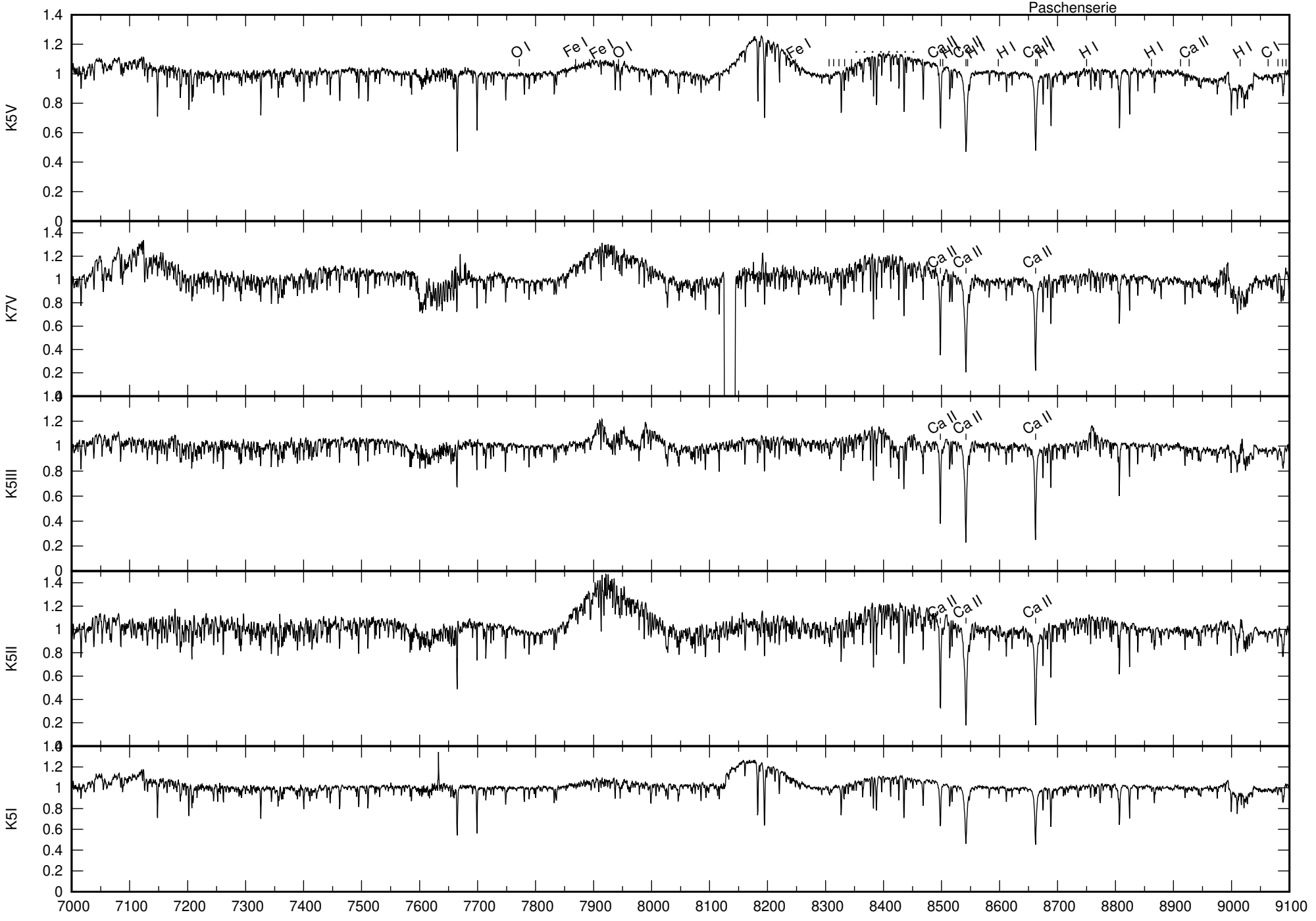
6900
7000


Paschenserie
K5V
K7V
K5III
K5II
K5I
O I
Fe I
Fe I
O I
Fe I
Ca II
Ca II
Ca II
H I
Ca II
H I
H I
H I
Ca II
H I
C I
Ca II
Ca II
Ca II
Ca II
Ca II
Ca II
Ca II
Ca II
Ca II
0
0.2
0.4
0.6
0.8
1
1.2
1.4
7000
7100
7200
7300
7400
7500
7600
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8300
8400
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8600
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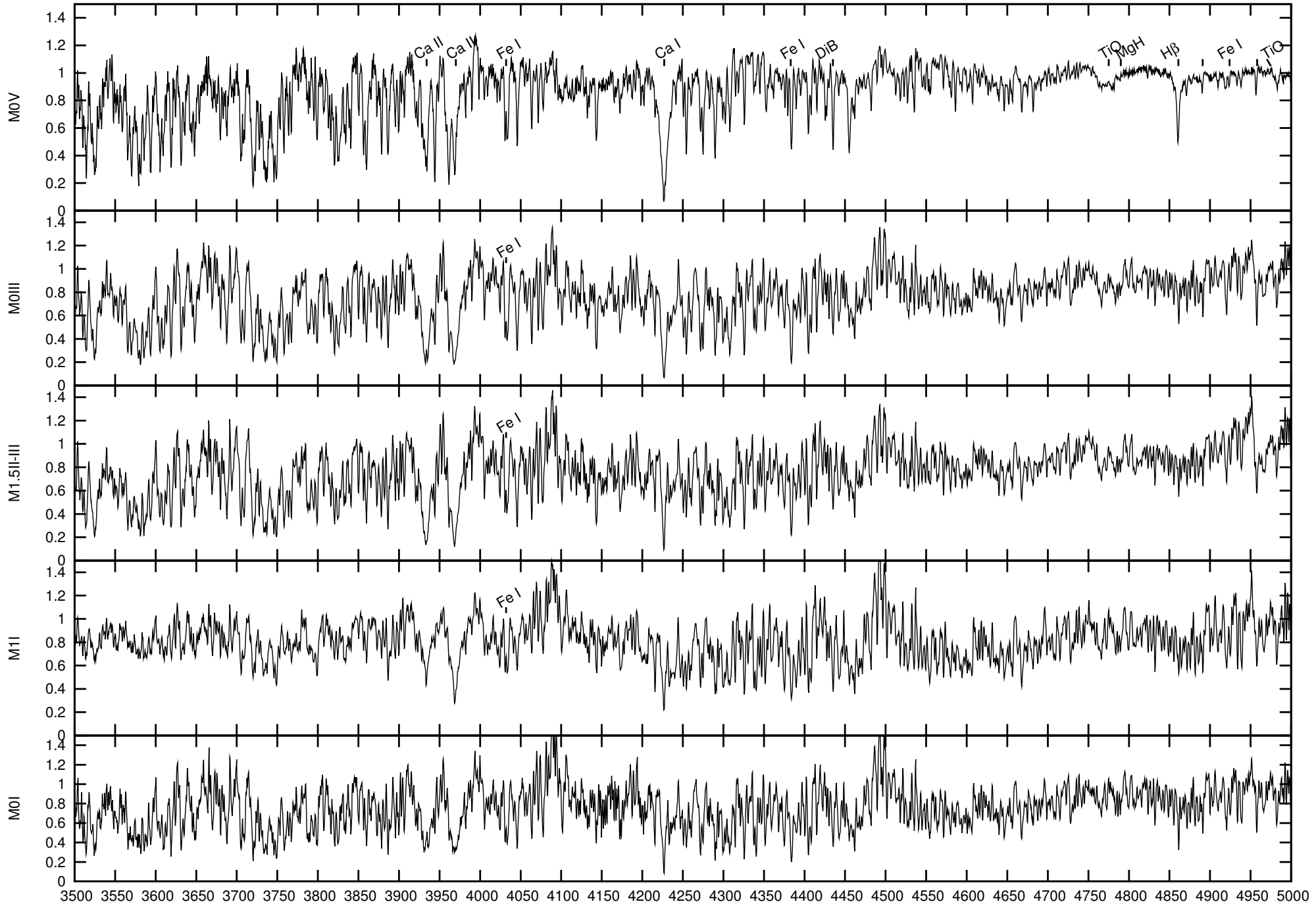
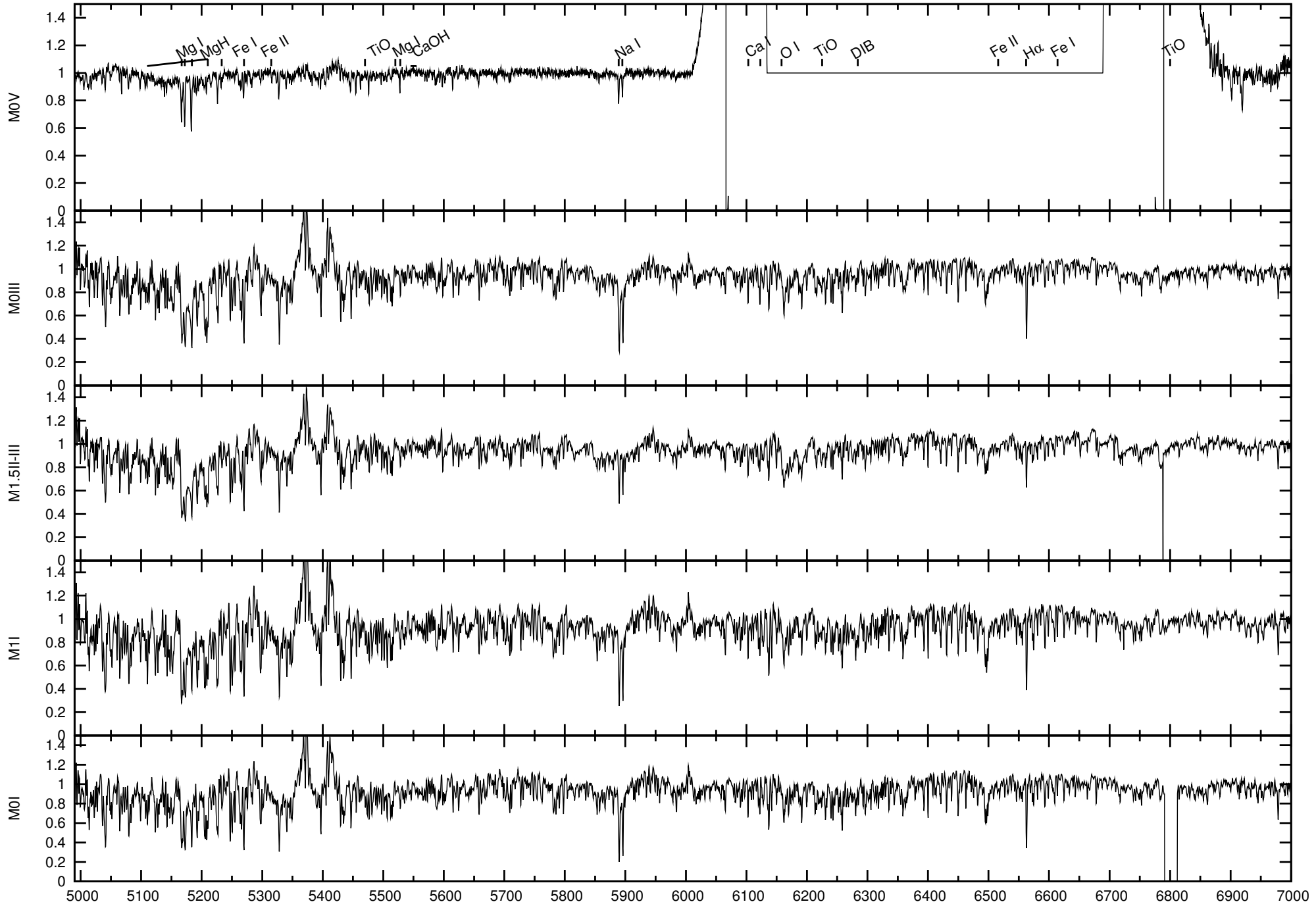
9000
9100


M0V
M0III
M1.5II-III
M1I
M0I
Ca II
Ca II
Fe I
Ca I
Fe I
DiB
TiO
MgH
Hβ
Fe I
TiO
Fe I
Fe I
Fe I
0
0.2
0.4
0.6
0.8
1
1.2
1.4
3500 3550 3600 3650 3700 3750 3800 3850 3900 3950 4000 4050 4100 4150 4200 4250 4300 4350 4400 4450 4500 4550 4600 4650 4700 4750 4800 4850 4900 4950 5000


M0V
M0III
M1.5II-III
M1I
M0I
Mg I
MgH
Fe I
Fe II
TiO
Mg I
CaOH
Na I
Ca I
O I
TiO
DIB
Fe II
Hα
Fe I
TiO
0
0.2
0.4
0.6
0.8
1
1.2
1.4
5000
5100
5200
5300
5400
5500
5600
5700
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5900
6000
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6200
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6500
6600
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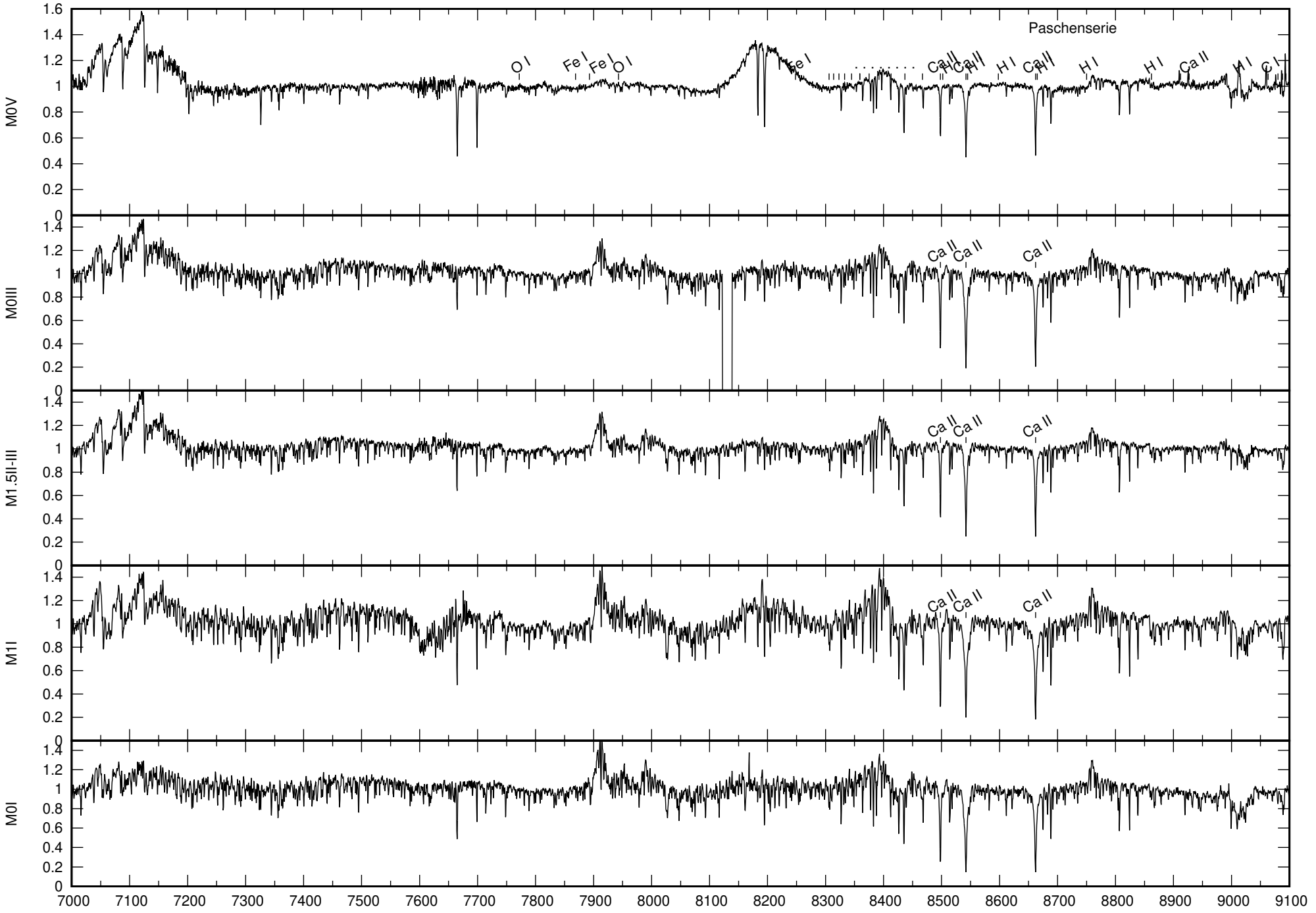
7000


Paschenserie
O I
Fe I
Fe I
O I
Fe I
Ca II
Ca II
H I
Ca II
H I
H I
H I
Ca II
H I
C I
M0V
M0III
M1.5II-III
M1I
M0I
Ca II
Ca II
Ca II
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
7000
7100
7200
7300
7400
7500
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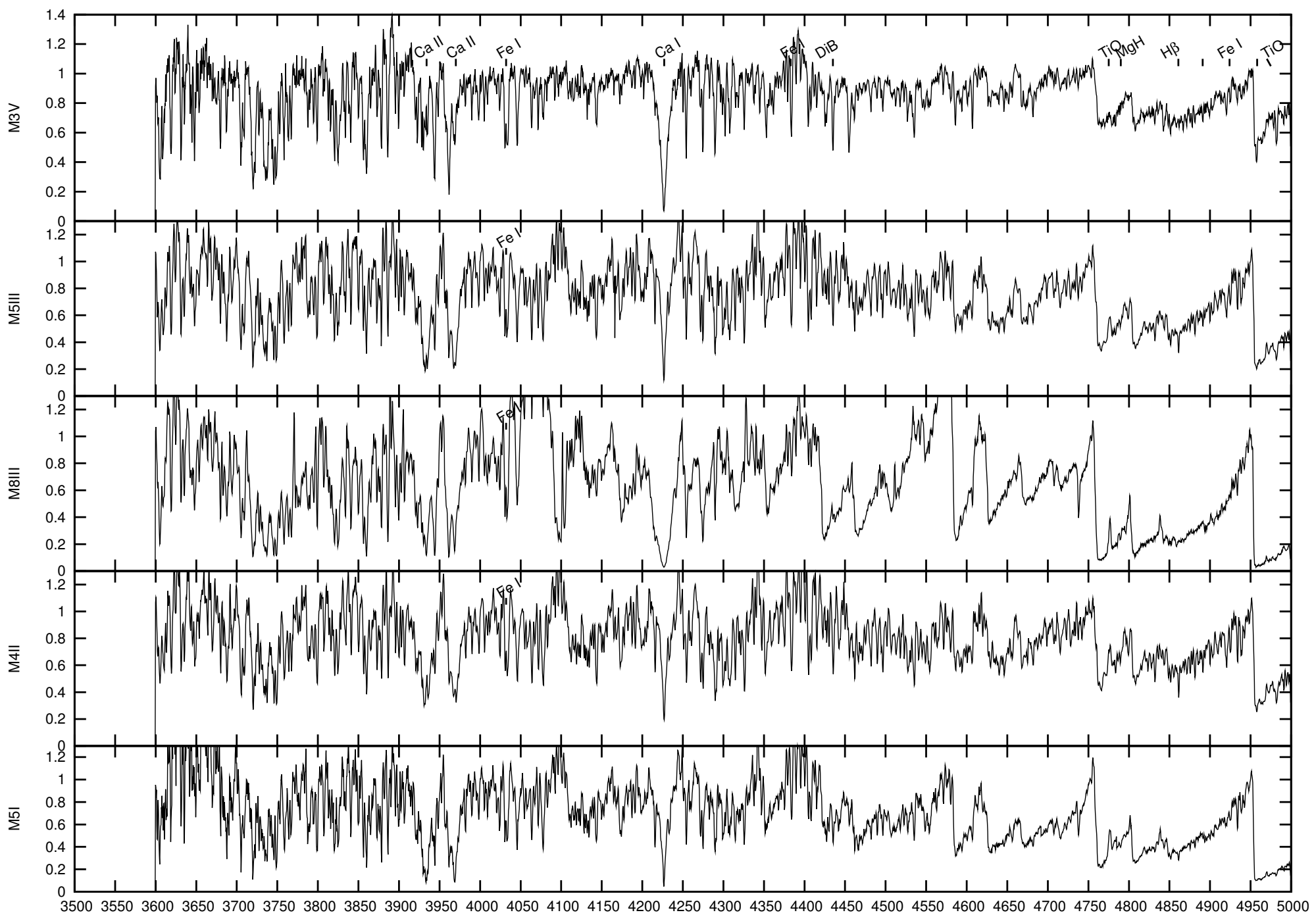
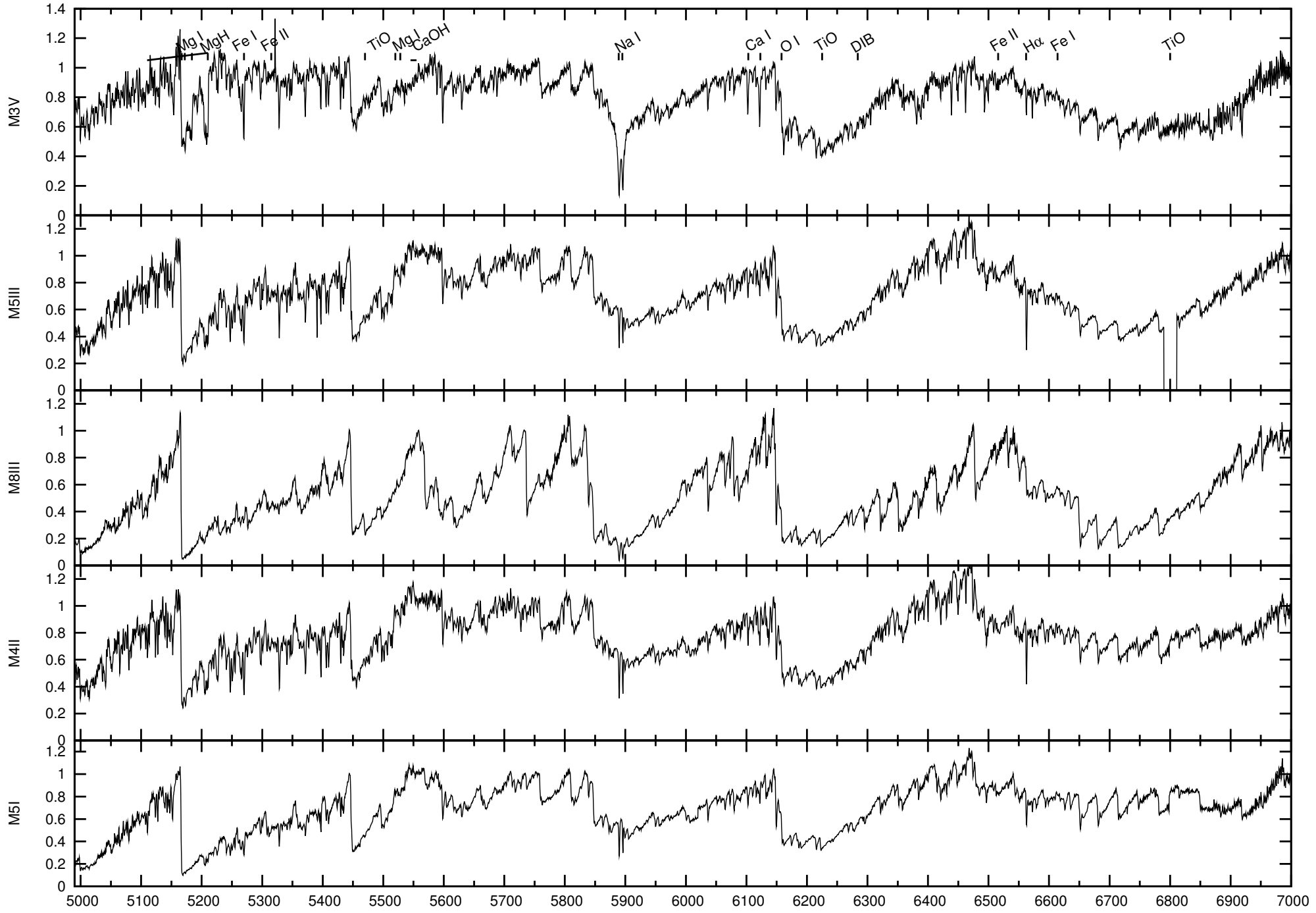

M3V
M5III
M8III
M4II
M5I
Ca II
Ca II
Fe I
Ca I
Fe I
DiB
TiO
MgH
Hβ
Fe I
TiO
Fe I
Fe I
Fe I
0
0.2
0.4
0.6
0.8
1
1.2
1.4
3500 3550 3600 3650 3700 3750 3800 3850 3900 3950 4000 4050 4100 4150 4200 4250 4300 4350 4400 4450 4500 4550 4600 4650 4700 4750 4800 4850 4900 4950 5000


M3V
M5III
M8III
M4II
M5I
Mg I
MgH
Fe I
Fe II
TiO
Mg I
CaOH
Na I
Ca I
O I
TiO
DIB
Fe II
Hα
Fe I
TiO
0
0.2
0.4
0.6
0.8
1
1.2
1.4
5000
5100
5200
5300
5400
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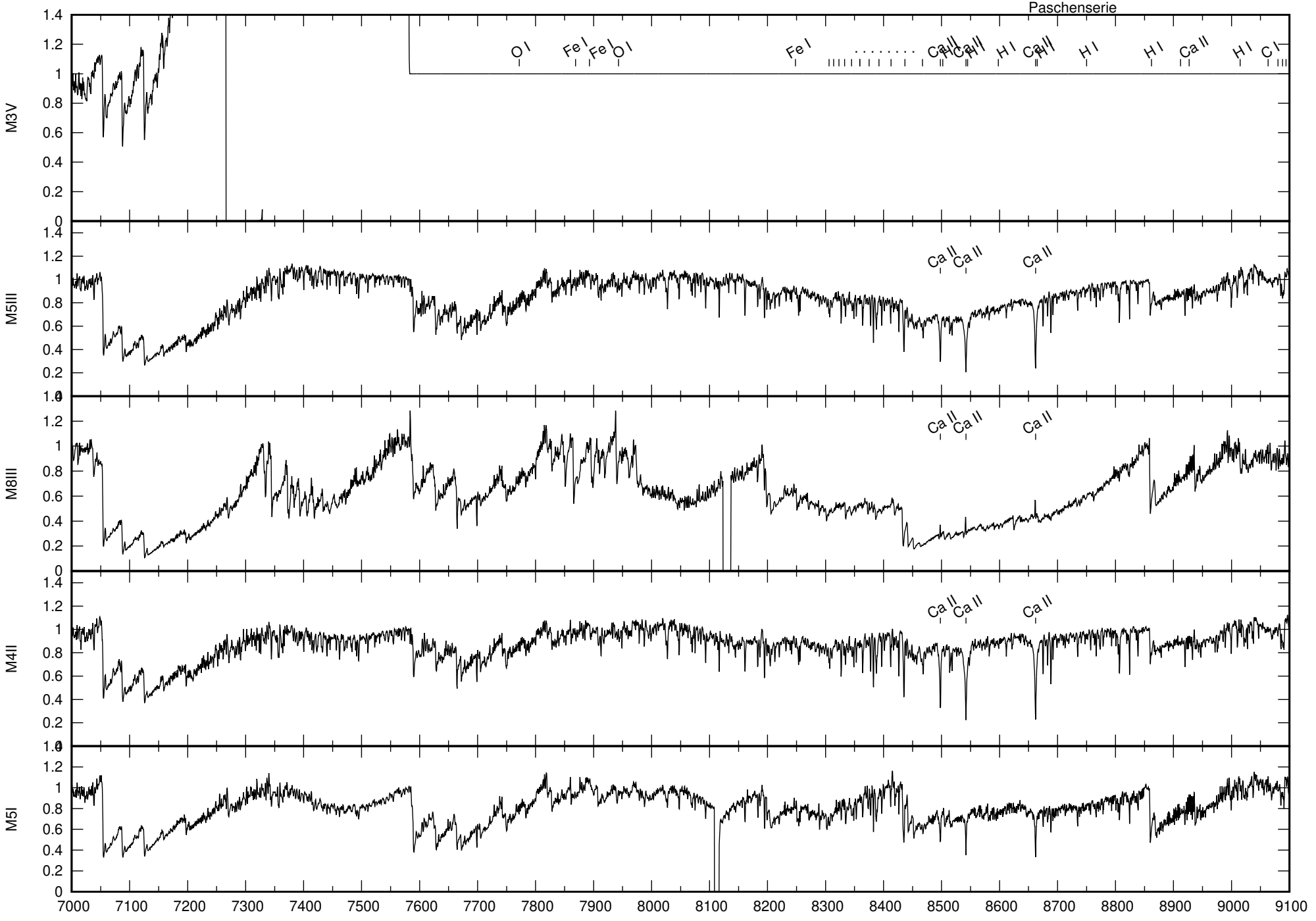
Paschenserie
O I
Fe I
Fe I
Fe I
O I
Fe I
Ca II
H I
Ca II
H I
H I
Ca II
H I
H I
Ca II
H I
C I
M3V
M5III
M8III
M4II
M5I
Ca II
Ca II
Ca II
0
0.2
0.4
0.6
0.8
1
1.2
1.4
7000
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7200
7300
7400
7500
7600
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8000
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