

Sintesi di popolazione

Analisi spettrale della popolazione stellare di una galassia

Obiettivi

Studiare la popolazione stellare di una serie di galassie a partire dal confronto degli spettri galattici con quelli di 44 tipi spettrali di stelle e stimarne quantità e distribuzioni.

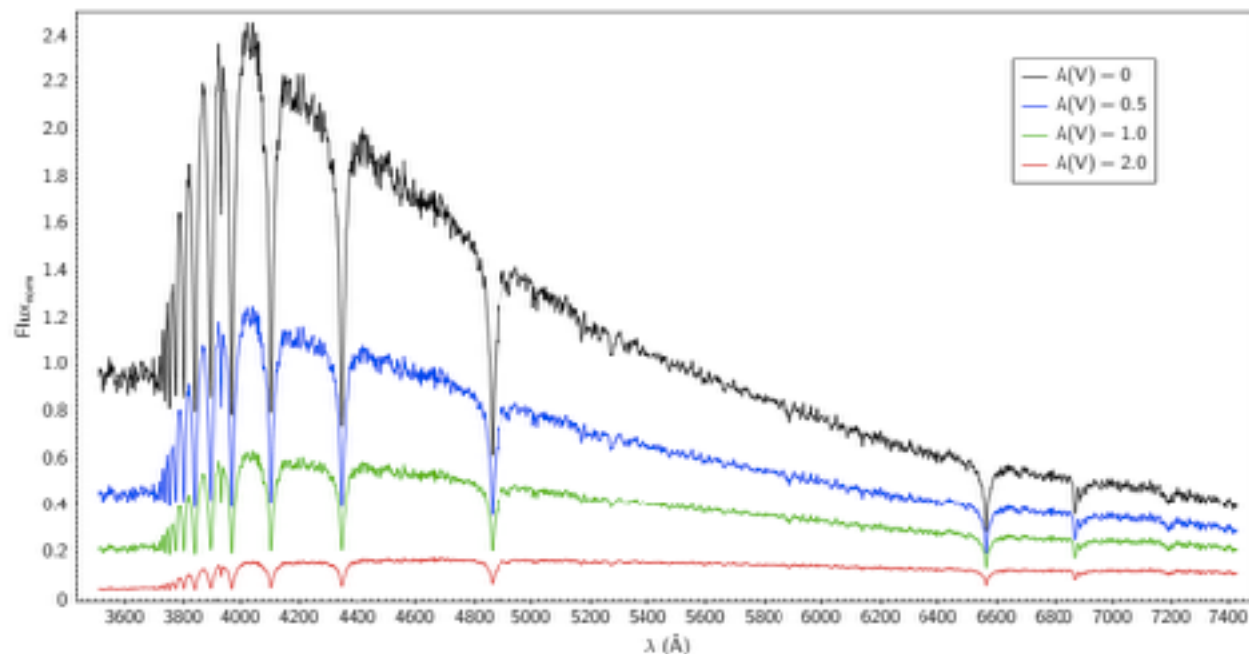
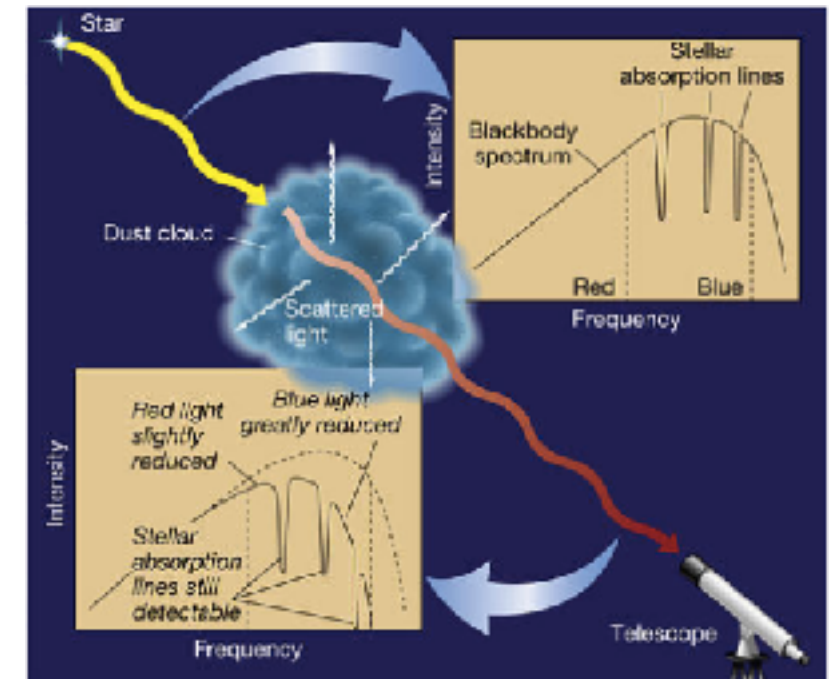
Procedimento

1. Con l'ausilio del programma TOPCAT, confrontare gli spettri delle galassie con quelli delle stelle e ricavarne la composizione in termini di popolazione stellare.

$$G(\lambda) = \sum_{i=1}^n a_i \times S_i(\lambda)$$

Procedimento

2. Una volta trovata la corretta combinazione di spettri stellari (ricordandosi che la somma dei coefficienti deve essere pari a 1), bisogna correggere eventuali variazioni dovute alla presenza di gas e polveri attraversate dalla luce.



$$G(\lambda) = \left(\sum_{i=1}^n a_i \times S_i(\lambda) \right) \times 10^{-0.4 \times A(V) \times f(\lambda)}$$

Procedimento

3. In seguito, calcolare la distanza delle galassie (espressa in Mpc) a partire dal valore del loro redshift; convertire poi questo valore in cm.

$$d = \frac{cz}{H_0} \quad (\text{Mpc}) \qquad H_0 = 72 \text{ km s}^{-1} \text{ Mpc}^{-1}$$

Procedimento

4. A questo punto, calcolare la luminosità della galassia moltiplicando il quadrato della distanza espressa in cm per il flusso totale. Esprimere poi questo valore in luminosità solari.

$$L = 4\pi d^2 f \quad (\text{erg s}^{-1}) \quad L_{\text{Sole}} = 3.8 \times 10^{33} \quad \text{erg s}^{-1}$$

Dati di partenza

Galassia	Flusso	Redshift	Assorbimento
IC 1241	3.92009E-12	0.016431	0.063
UGC 01794	7.47201E-12	0.025966	0.097
NGC 0830	8.41036E-12	0.013449	0.062
NGC 1143	4.61632E-12	0.028708	0.198
2MASX J23301966+1326572	4.91974E-12	0.040387	0.173
NGC 7651	5.95043E-12	0.043079	0.131
CGCG 128-035	6.93356E-12	0.022426	0.060
MRK 0837	9.03707E-12	0.032187	0.117
SDSS J160703.18+153535.1	3.50131E-12	0.039861	0.116
IC 2217	1.42504E-12	0.017572	0.112
SDSS J160937.51+280306.6	1.79255E-12	0.032983	0.111
CGCG 125-030	2.24438E-12	0.022428	0.062

Procedimento

5. Infine, trovare la quantità stimata delle diverse categorie di stelle all'interno delle galassie, moltiplicando la luminosità ottenuta per la percentuale di ciascun tipo di stelle e dividendola per la loro luminosità espressa in luminosità solari.

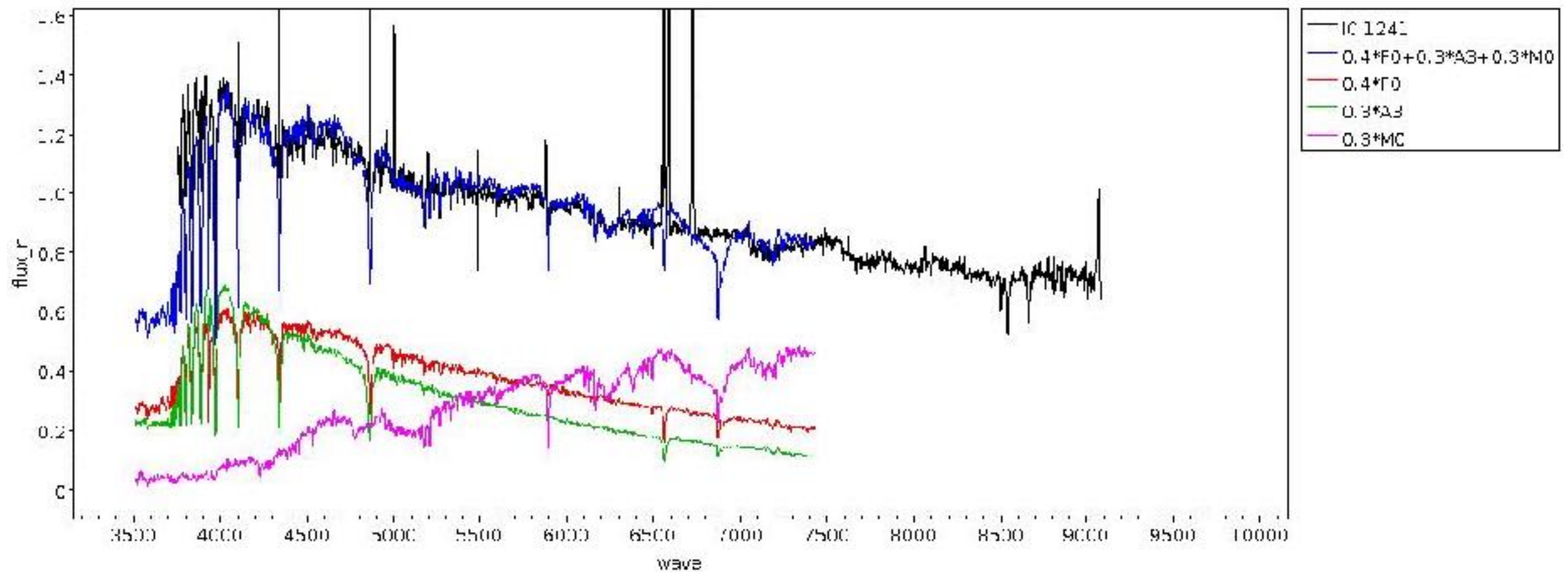
Spectral Type	Temperature (K)	Absolute Magnitude	Luminosity (in solar luminosities)
O5	54,000	-4.5	200,000
O6	45,000	-4.0	140,000
O7	43,300	-3.9	120,000
O8	40,600	-3.8	80,000
O9	37,800	-3.6	55,000
B0	29,200	-3.3	24,000
B1	23,000	-2.3	5550
B2	21,000	-1.9	3190
B3	17,600	-1.1	1060
B5	15,200	-0.4	380
B6	14,300	0	240
B7	13,500	0.3	140
B8	12,300	0.7	73
B9	11,400	1.1	42
A0	9600	1.5	24
A1	9330	1.7	20
A2	9040	1.8	17
A3	8750	2.0	14
A4	8480	2.1	12
A5	8310	2.2	11
A7	7920	2.4	8.8
F0	7350	3.0	5.1
F2	7050	3.3	3.8
F3	6850	3.5	3.2
F5	6700	3.7	2.7
F6	6550	4.0	2.0
F7	6400	4.3	1.5
F8	6300	4.4	1.4

G0	6050	4.7	1.2
G1	5930	4.9	1.1
G2	5800	5.0	1
G5	5660	5.2	0.73
G8	5440	5.6	0.51
K0	5240	6.0	0.38
K1	5110	6.2	0.32
K2	4960	6.4	0.29
K3	4800	6.7	0.24
K4	4600	7.1	0.18
K5	4400	7.4	0.15
K7	4000	8.1	0.11
M0	3750	8.7	0.080
M1	3700	9.4	0.055
M2	3600	10.1	0.035
M3	3500	10.7	0.027
M4	3400	11.2	0.022
M5	3200	12.3	0.011
M6	3100	13.4	0.0051
M7	2900	13.9	0.0032
M8	2700	14.4	0.0020



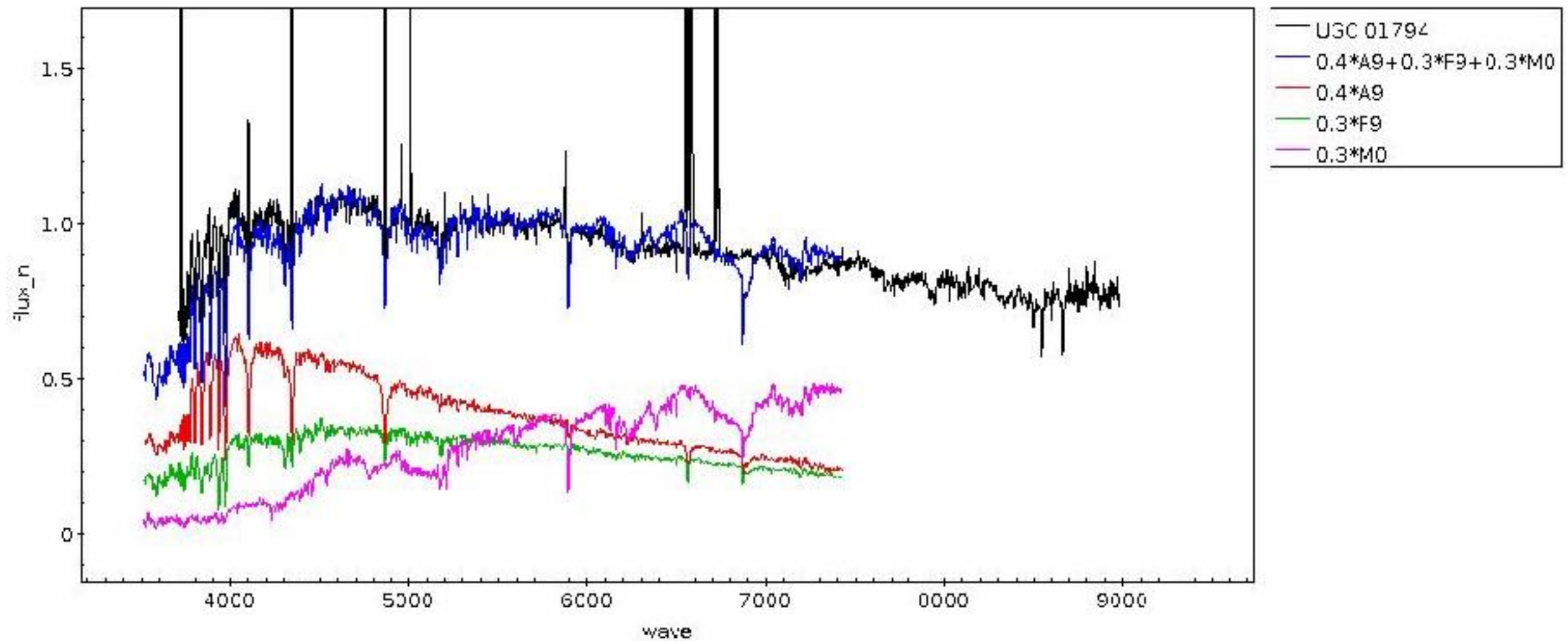
F5	6700	3.7	2.7
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Risultati



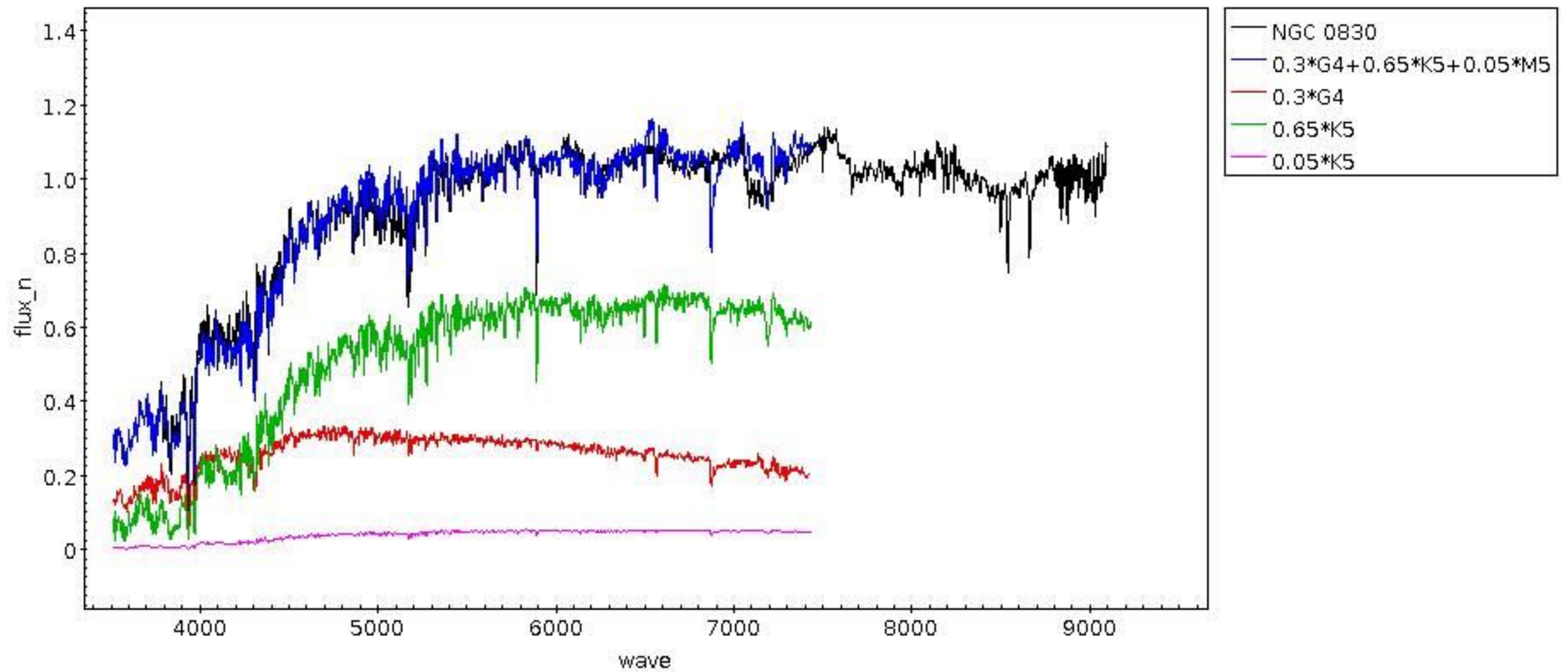
$$G(\lambda) = 0.3 \cdot A3 + 0.4 \cdot F0 + 0.3 \cdot M0$$

Risultati



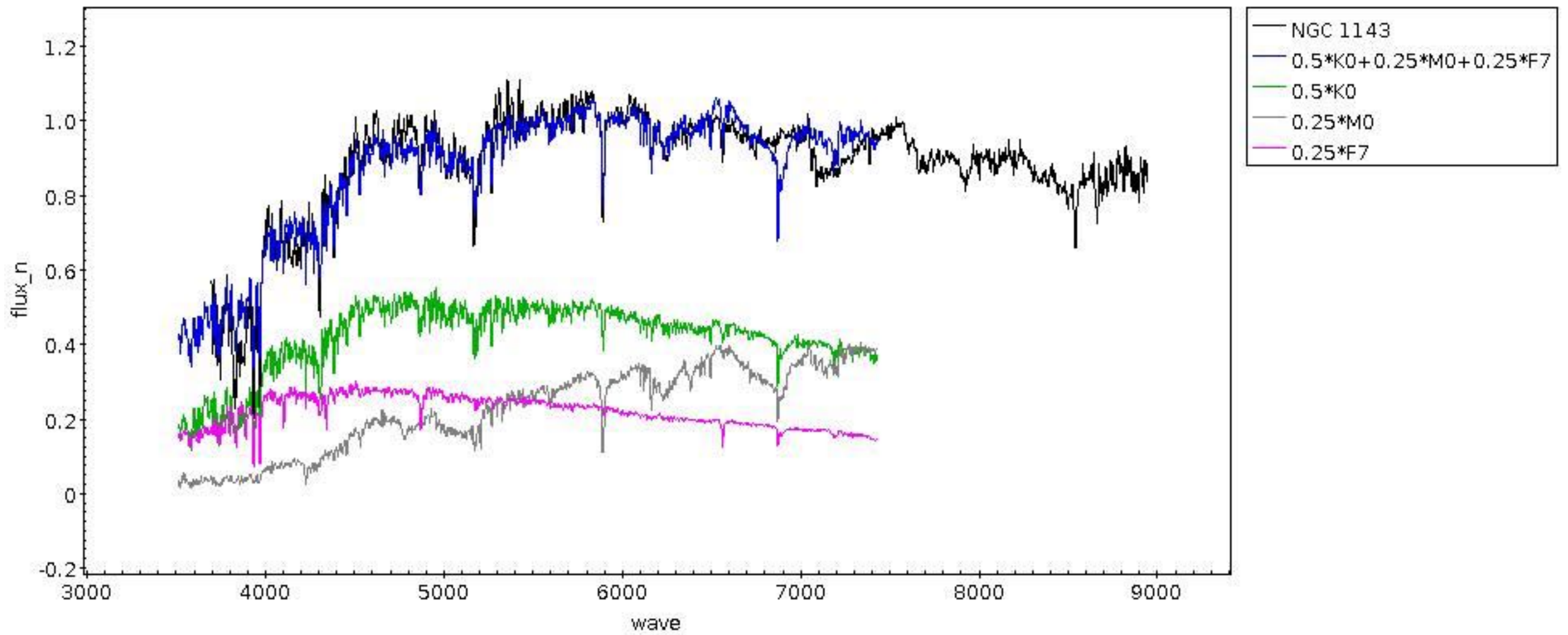
$$G(\lambda)=0.4*A9+0.3*F9+0.3*M0$$

Risultati



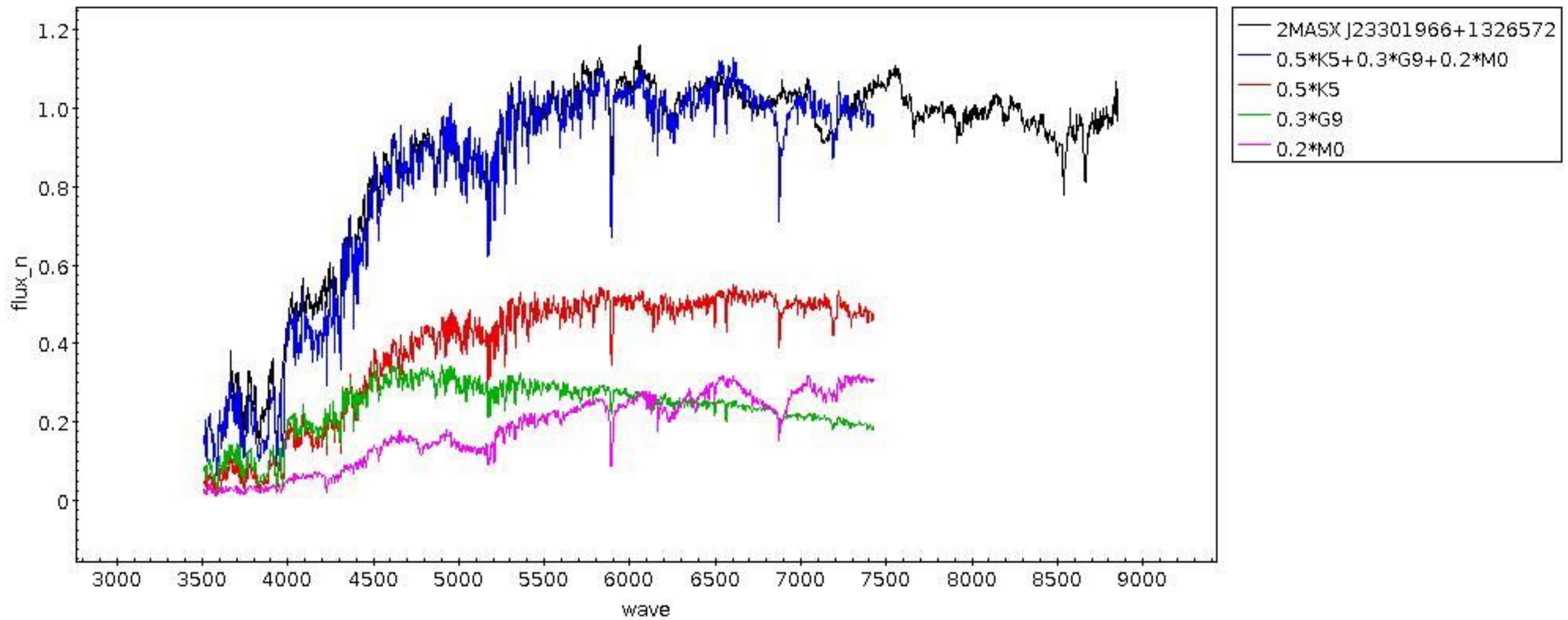
$$G(\lambda)=0.3*G4+0.65*K5+0.05*M5$$

Risultati



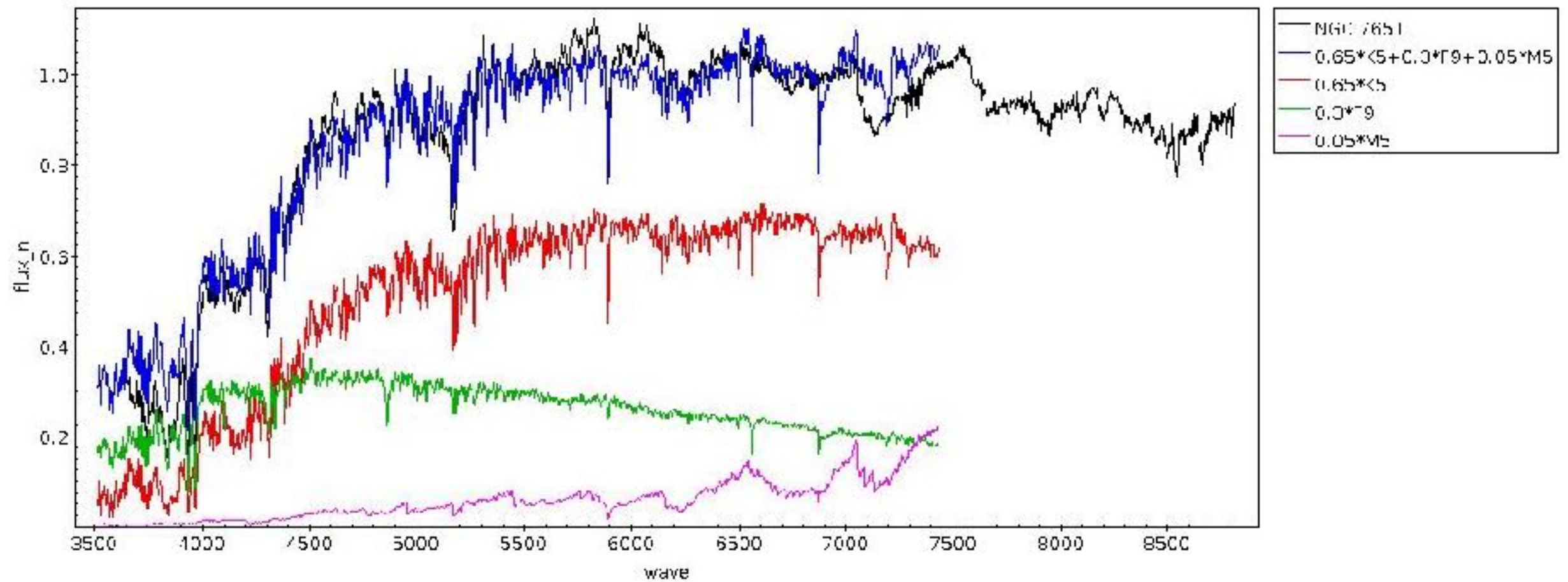
$$G(\lambda)=0.25*F7+0.5*K0+0.25*M0$$

Risultati



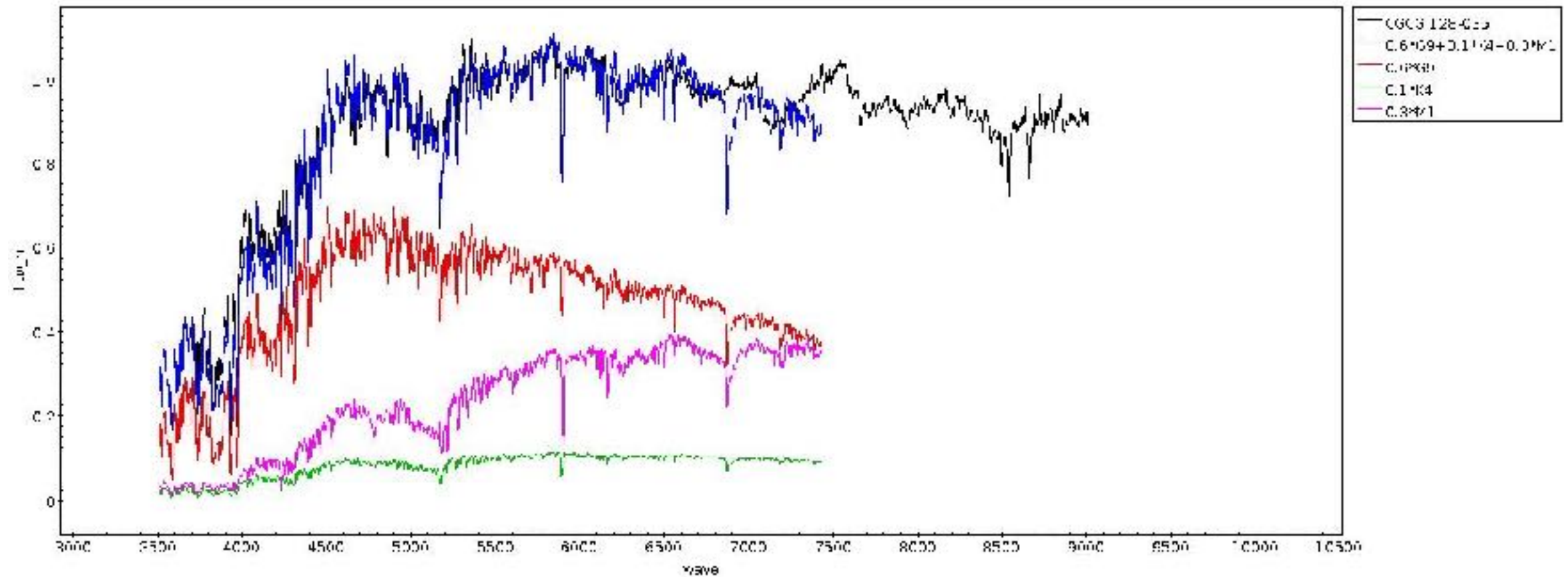
$$G(\lambda)=0.3*G9+0.5*K5+0.2*M0$$

Risultati



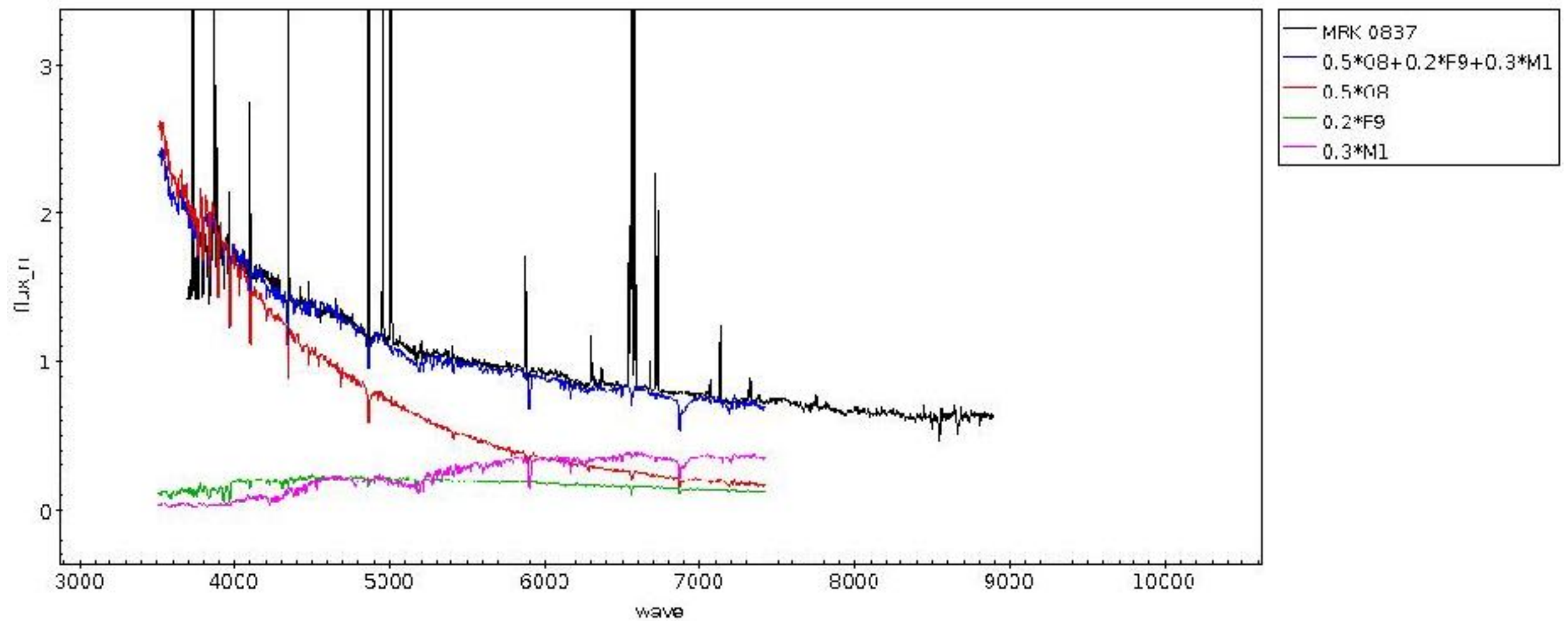
$$G(\lambda) = 0.3 \times F9 + 0.65 \times K5 + 0.05 \times M5$$

Risultati



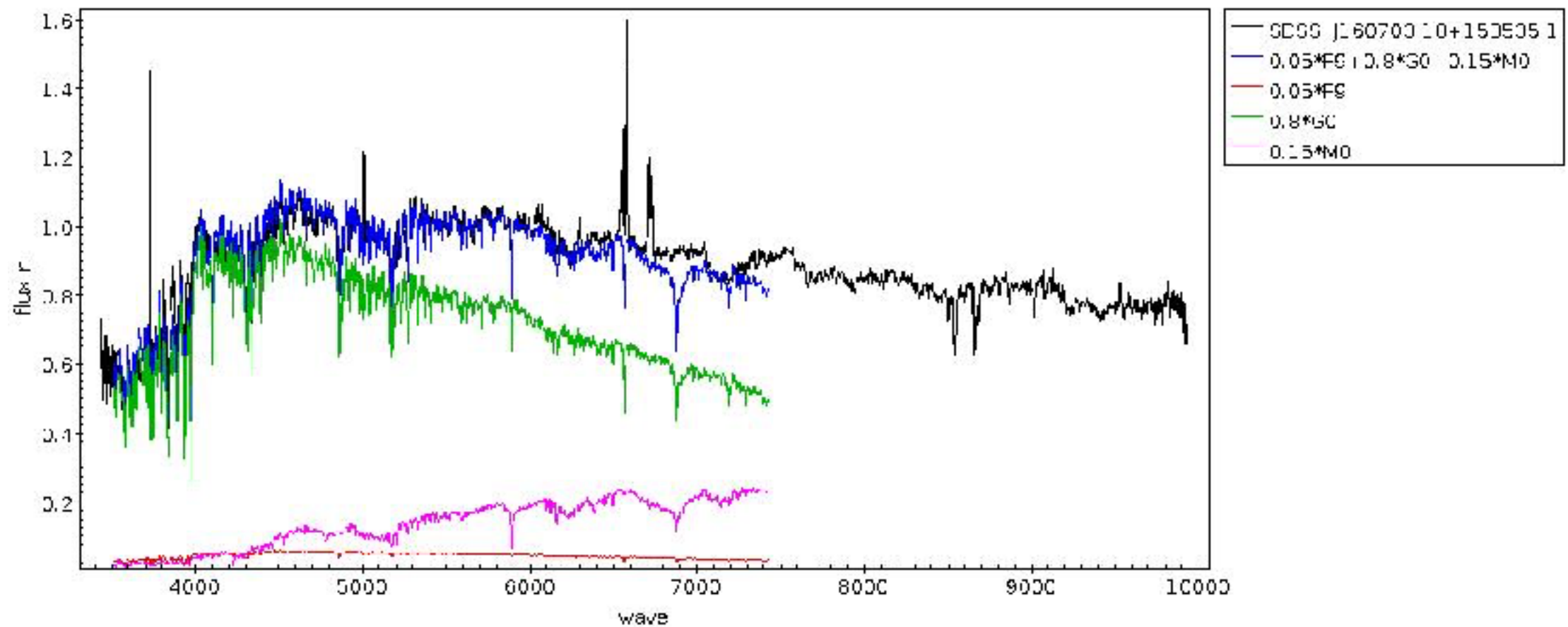
$$G(\lambda)=0.6*G9+0.1*K4+0.3*M1$$

Risultati



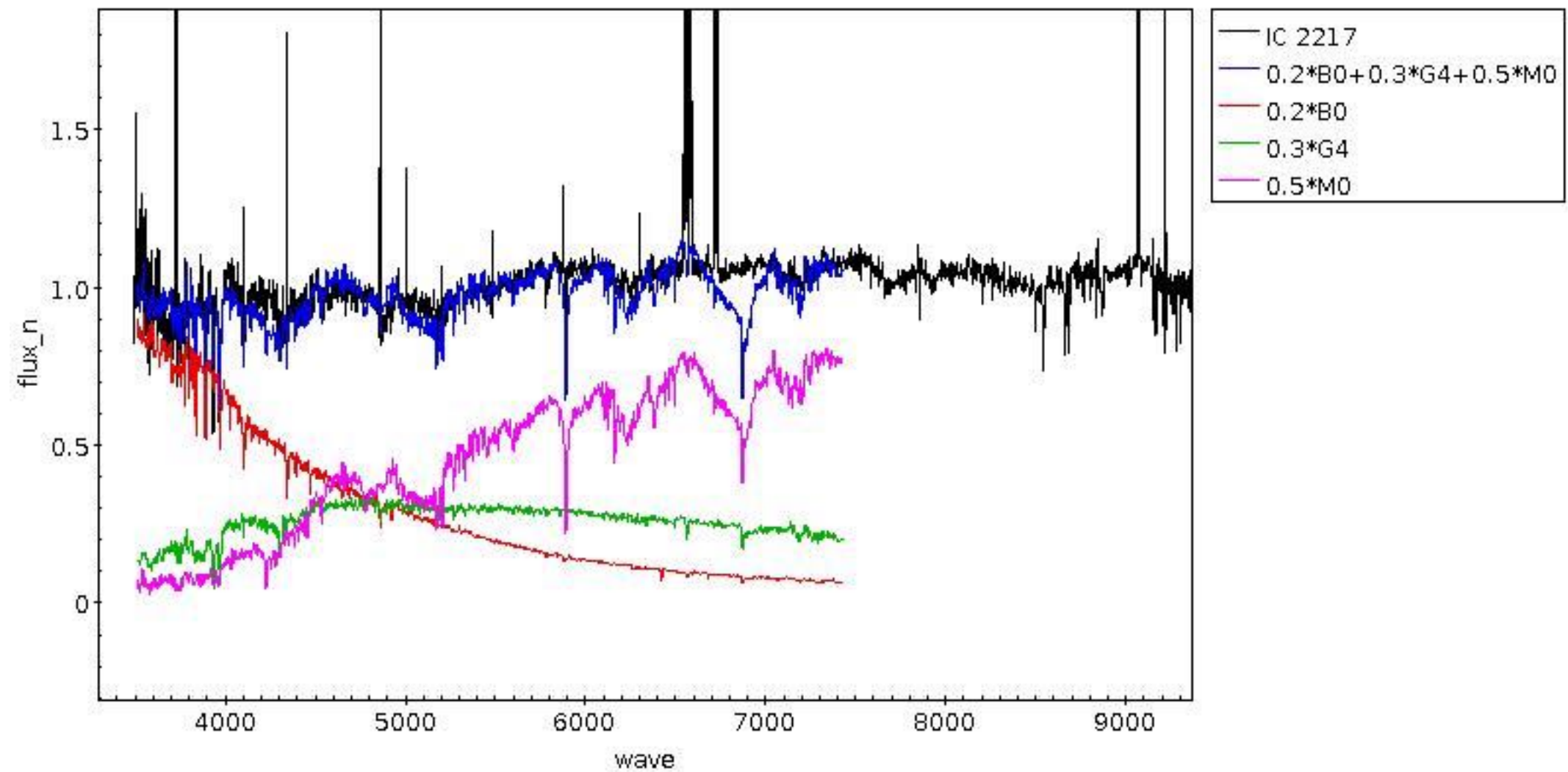
$$G(\lambda)=0.5*\text{O8}+0.2*\text{F9}+0.3*\text{M1}$$

Risultati



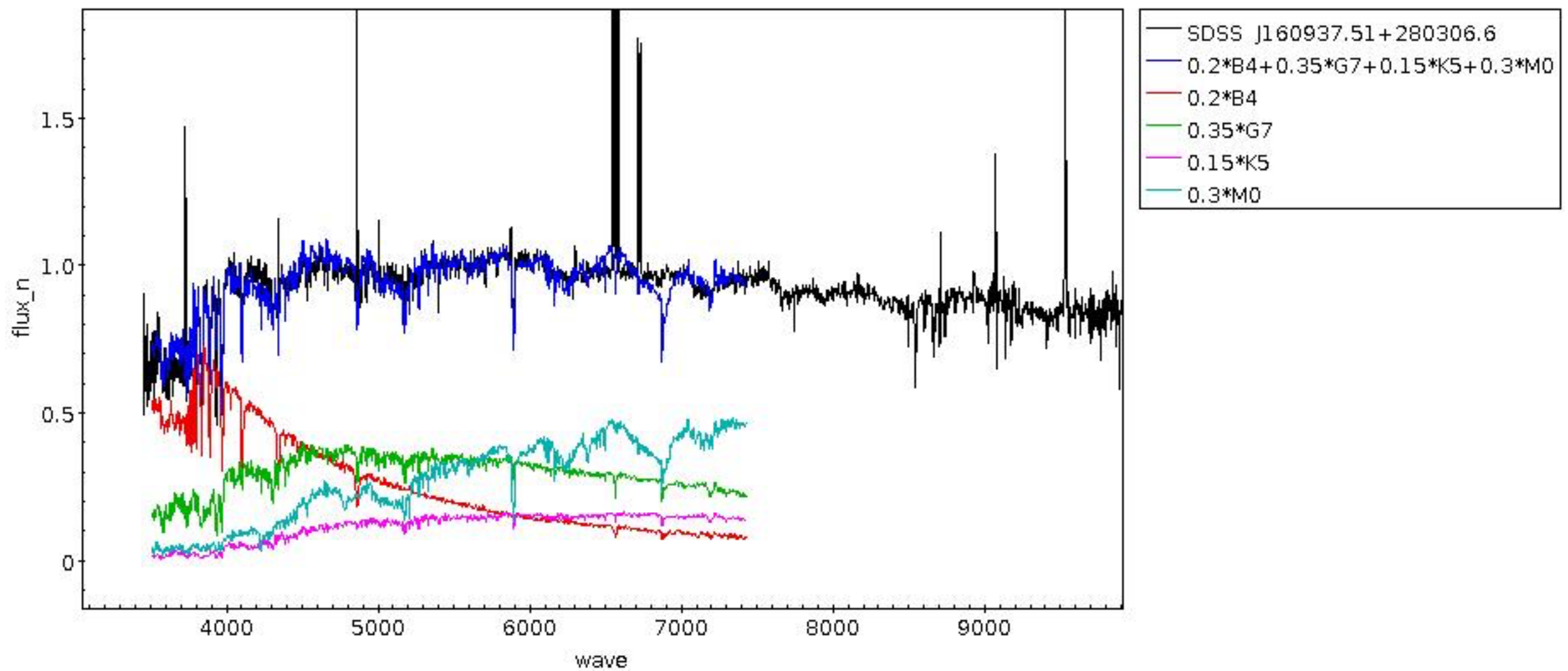
$$G(\lambda)=0.05*F9+0.8*G0+0.15*M0$$

Risultati



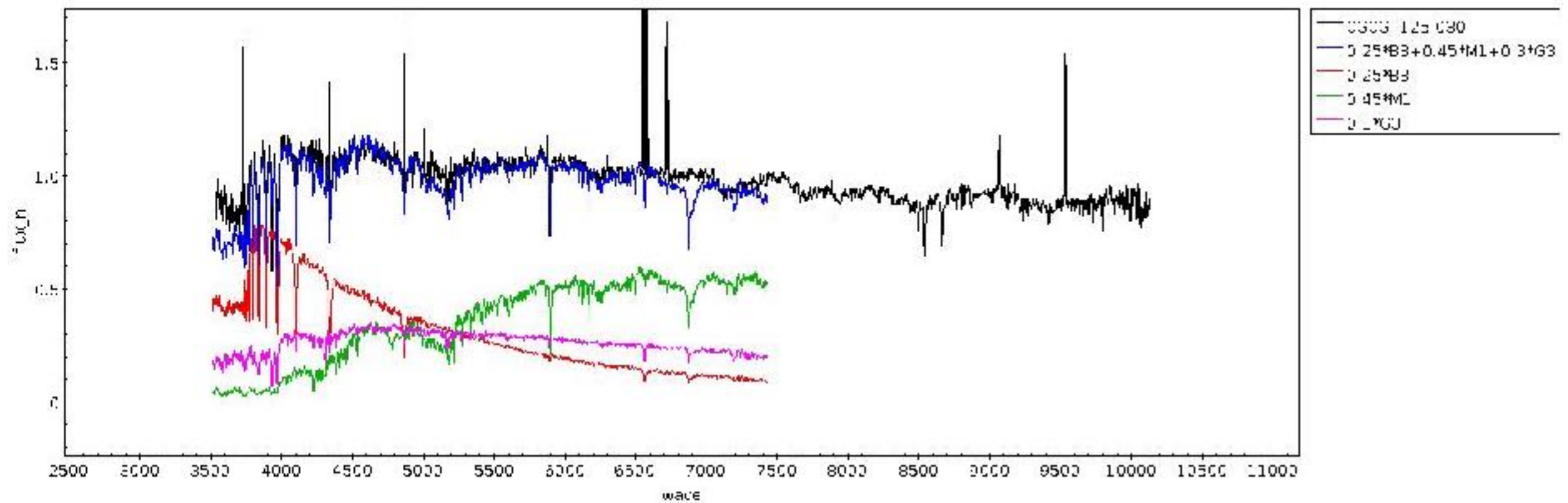
$$G(\lambda)=0.2*B0+0.3*G4+0.5*M0$$

Risultati



$$G(\lambda)=0.2*B4+0.35*G7+0.15*K5+0.3*M0$$

Risultati



$$G(\lambda)=0.25*B8+0.3*G3+0.45*M1$$

Risultati

Galassia	Sintesi di popolazione
IC 1241	$G(\lambda)=0.3*A3+0.4*F0+0.3*M0$
UGC 01794	$G(\lambda)=0.4*A9+0.3*F9+0.3*M0$
NGC 0830	$G(\lambda)=0.3*G4+0.65*K5+0.05*M5$
NGC 1143	$G(\lambda)=0.25*F7+0.5*K0+0.25*M0$
2MASX J23301966+1326572	$G(\lambda)=0.3*G9+0.5*K5+0.2*M0$
NGC 7651	$G(\lambda)=0.3*F9+0.65*K5+0.05*M5$
CGCG 128-035	$G(\lambda)=0.6*G9+0.1*K4+0.3*M1$
MRK 0837	$G(\lambda)=0.5*O8+0.2*F9+0.3*M1$
SDSS J160703.18+153535.1	$G(\lambda)=0.05*F9+0.8*G0+0.15*M0$
IC 2217	$G(\lambda)=0.2*B0+0.3*G4+0.5*M0$
SDSS J160937.51+280306.6	$G(\lambda)=0.2*B4+0.35*G7+0.15*K5+0.3*M0$
CGCG 125-030	$G(\lambda)=0.25*B8+0.3*G3+0.45*M1$

Risultati

Galassia	O8	B0	B4	B8	A3	A9	F0
IC 1241					$1.24 \cdot 10^7$		$4.54 \cdot 10^7$
UGC 01794						$1.25 \cdot 10^8$	
NGC 0830							
NGC 1143							
2MASX							
NGC 7651							
CGCG 128-035							
MRK 0837	$3.2 \cdot 10^4$						
SDSS							
IC 2217		$2.00 \cdot 10^3$					
SDSS			$2.01 \cdot 10^5$				
CGCG 125-030				$9.43 \cdot 10^6$			

Risultati

Galassia	F7	F9	G0	G3	G4	G7	G9
IC 1241							
UGC 01794		$5.9 \cdot 10^8$					
NGC 0830					$3.42 \cdot 10^8$		
NGC 1143	$3.47 \cdot 10^8$						
2MASX							$2.58 \cdot 10^9$
NGC 7651		$1.29 \cdot 10^9$					
CGCG 128-035							$2.24 \cdot 10^9$
MRK 0837		$7.31 \cdot 10^8$					
SDSS		$1.09 \cdot 10^8$	$2.00 \cdot 10^9$				
IC 2217					$7.21 \cdot 10^7$		
SDSS						$7.31 \cdot 10^8$	
CGCG 125-030				$8.26 \cdot 10^8$			

Risultati

Galassia	K0	K4	K5	MO	M1	M5	TOTAL
IC 1241				$2.17 \cdot 10^9$			$2.23 \cdot 10^9$
UGC 01794				$1.03 \cdot 10^{10}$			$1.1 \cdot 10^{10}$
NGC 0830			$3.6 \cdot 10^9$			$3.78 \cdot 10^9$	$7.72 \cdot 10^9$
NGC 1143	$2.74 \cdot 10^9$			$6.5 \cdot 10^9$			$9.58 \cdot 10^9$
2MASX			$1.46 \cdot 10^{10}$	$1.10 \cdot 10^{10}$			$2.82 \cdot 10^{10}$
NGC 7651			$2.61 \cdot 10^{10}$			$2.7 \cdot 10^{10}$	$5.44 \cdot 10^{10}$
CGCG 128-035		$1.06 \cdot 10^9$			$1.04 \cdot 10^{10}$		$1.37 \cdot 10^{10}$
MRK 0837					$2.79 \cdot 10^{10}$		$2.86 \cdot 10^{10}$
SDSS				$5.7 \cdot 10^9$		$2.76 \cdot 10^9$	$1.05 \cdot 10^{10}$
IC 2217				$1.5 \cdot 10^9$			$1.57 \cdot 10^9$
SDSS			$1.07 \cdot 10^9$	$4 \cdot 10^9$			$5.9 \cdot 10^9$
CGCG 125-030					$2.25 \cdot 10^{10}$		$2.33 \cdot 10^{10}$

Grazie per l'attenzione! :)