

# 疑似等価幅によるM型サブタイプ と有効温度の推定

part 2 R～1000の場合

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以前R~500分光器による同様の疑似等価幅測定を行ったが、  
(<https://otobs.org/FBO/mutter/Msub.pdf>)

**疑似等価幅値は分光器の分解能に左右されることが判明した。**

今回R~1000の分光器(NLS)を製作したので、改めてM型星を観測し直し、そのサブタイプと有効温度推定を行った。

スペクトルは40cmSCT+NLS(R~1000)を用い、分光標準星による波長感度較正を行った。

また地球大気吸収バンドの補正も行った。

1例として図1に15 Triの地球大気補正前と補正後のスペクトルを示す。

また測定した疑似等価幅のew1~ew8の積分波長範囲を示す。

15 Tri (NS V866) Sp. M3III 2023/07/27.794 (UT)

NS V00866 023547.43 +344115.6 LB: 5.39 (0.14) V - - - M3 -

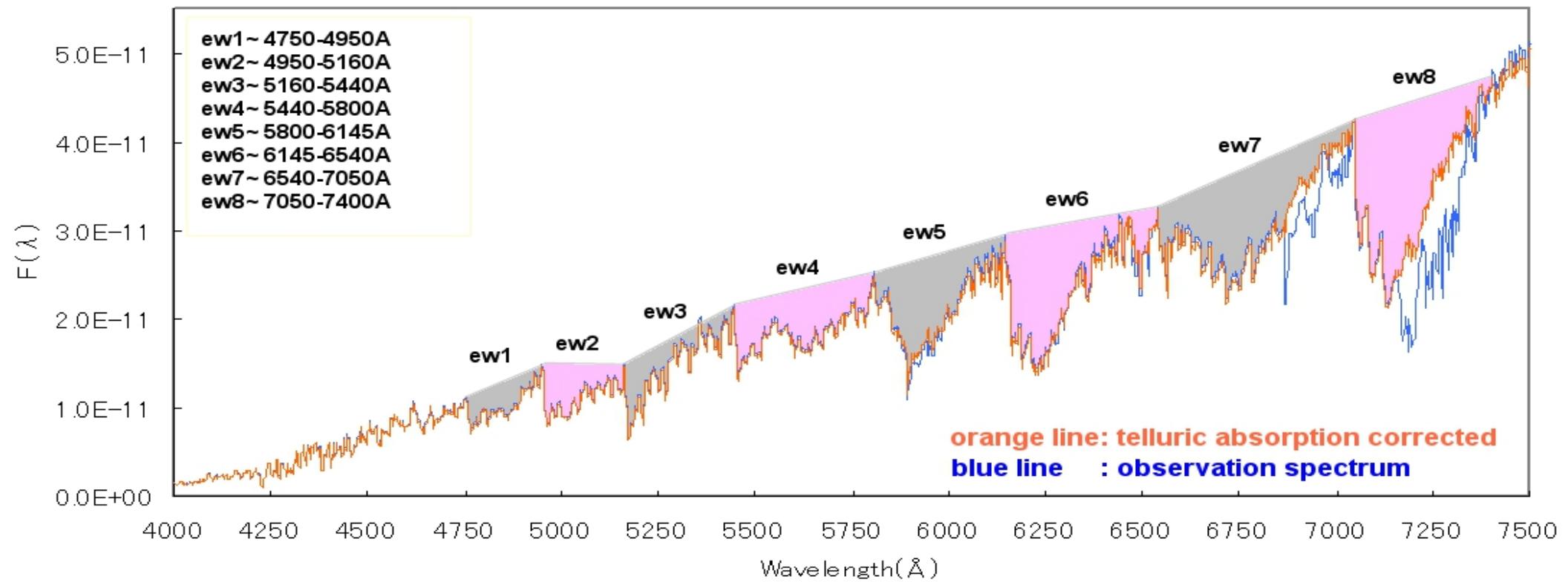


図1 地球大気補正後のスペクトル(橙色)を用いて、ew1～ew8の8箇所の疑似等価幅を測定する。

訂正: <https://otobs.org/FBO/mutter/Msub.pdf> の図1で示した地球大気補正後のスペクトル図はミスしていた。分光標準星の連続光規格化スペクトルでオブジェクトスペクトルを割り算すべきところを掛け算したグラフだった…。なお測定した疑似等価幅値は割り算したもの用いているので問題なし。

| No | star      | Mag.           | Range | Sp. Type    | M-subtype | ew1   | ew2   | ew3   | ew4   | ew5   | ew6   | ew7   | ew8   | ew1-8 total | YMD(UT)         |                 |                |
|----|-----------|----------------|-------|-------------|-----------|-------|-------|-------|-------|-------|-------|-------|-------|-------------|-----------------|-----------------|----------------|
| 1  | CG Cam    | 5.15 - 5.27    | Hp    | M0 III C    |           | 0.0   | 29.2  | 34.9  | 45.5  | 52.4  | 37.8  | 61.4  | 52.0  | 55.9        | 394             | 2023/02/06/0438 |                |
| 2  | μ UMa     | 3.03 - 3.10    | V     | M0 III B    |           | 0.0   | 50.7  | 39.7  | 53.3  | 42.9  | 56.7  | 51.7  | 55.8  | 394         | 2023/02/06/0435 |                 |                |
| 3  | α Aur     | 4.71 - 4.75    | V     | M0 III B    |           | 0.0   | 31.6  | 39.9  | 40.6  | 62.6  | 45.7  | 71.6  | 66.1  | 62.7        | 424             | 2023/02/14/0500 |                |
| 4  | β Cet     | 4.71 - 4.75    | V     | M0 III B    |           | 0.0   | 31.3  | 39.9  | 44.2  | 54.9  | 45.4  | 64.7  | 42.1  | 66.4        | 389             | 2023/02/17/782  |                |
| 5  | ζ Gem     | 4.04 - 4.09    | V     | M0 III B    |           | 0.0   | 27.7  | 34.5  | 31.2  | 52.4  | 40.1  | 58.7  | 57.7  | 51.3        | 355             | 2023/02/14/502  |                |
| 6  | 75 Leo    | -              |       | M0 III B    |           | 0.0   | 30.4  | 40.1  | 31.5  | 54.3  | 44.2  | 63.8  | 57.4  | 53.9        | 376             | 2023/02/07/765  |                |
| 7  | V439 Per  | 7.9 - 8.8      | V     | M0.5 Iab C  |           | 0.5   | 34.9  | 40.4  | 51.1  | 58.3  | 41.2  | 66.6  | 57.0  | 58.1        | 407             | 2023/02/08/435  |                |
| 8  | V1129 Cas | 8.51 - 8.74    | V     | M0.5 Iab C  |           | 0.5   | 36.4  | 42.8  | 53.6  | 62.0  | 50.6  | 75.0  | 64.5  | 70.1        | 455             | 2023/02/08/435  |                |
| 9  | V466 Cen  | 8.58 - 8.8     | V     | M0.5 Ib C   |           | 0.5   | 34.5  | 38.6  | 47.7  | 62.2  | 48.5  | 72.3  | 60.3  | 67.2        | 432             | 2023/02/08/412  |                |
| 10 | SAO11826  | 8.34 - 8.69    | V     | M0.5 Iab C  |           | 0.5   | 33.9  | 37.9  | 46.8  | 59.2  | 46.2  | 68.8  | 57.4  | 62.1        | 412             | 2023/02/06/423  |                |
| 11 | δ Oph     | 2.72 - 2.75    | V     | M0.5 Ib C   |           | 0.5   | 30.6  | 38.0  | 38.8  | 53.8  | 44.7  | 65.0  | 55.3  | 63.2        | 390             | 2023/03/13/781  |                |
| 12 | κ Cet     | 4.10 - 4.15    | V     | M0.5 Iab C  |           | 0.5   | 30.6  | 36.5  | 31.9  | 48.9  | 41.3  | 57.2  | 49.1  | 53.5        | 394             | 2023/02/13/793  |                |
| 13 | η Vul     | 4.39 - 4.44    | V     | M0.5 Iab C  |           | 0.5   | 30.6  | 34.4  | 31.9  | 52.2  | 50.4  | 47.8  | 56.4  | 56.1        | 361             | 2023/02/18/838  |                |
| 14 | η Vul     | 8.78 - 9.85    | V     | M1 Ia C     |           | 1.0   | 38.9  | 44.6  | 64.9  | 63.1  | 40.4  | 69.1  | 61.0  | 65.7        | 448             | 2023/04/27/768  |                |
| 15 | F2 Per    | 7.5 - 8.4      | V     | M1 Iab C    |           | 1.0   | 37.8  | 43.7  | 54.6  | 67.4  | 51.5  | 75.5  | 66.2  | 70.0        | 467             | 2023/02/08/446  |                |
| 16 | RP Per    | 7.7 - 8.2      | V     | M1 Iab-1b C |           | 1.0   | 38.9  | 44.3  | 56.9  | 68.0  | 52.2  | 74.1  | 71.2  | 68.8        | 474             | 2023/02/08/462  |                |
| 17 | HD49331   | 5.04 - 5.16    | V     | M1 Iab-1b C |           | 1.0   | 34.4  | 40.1  | 49.5  | 63.2  | 44.8  | 64.8  | 64.2  | 66.0        | 427             | 2023/02/14/487  |                |
| 18 | η Eri     | 4.38 - 4.44    | V     | M1 III C    |           | 1.0   | 33.0  | 42.3  | 42.4  | 57.3  | 49.5  | 71.7  | 68.2  | 64.5        | 329             | 2023/10/01/770  |                |
| 19 | σ Vir     | -              |       | M1 III C    |           | 1.0   | 34.3  | 43.8  | 42.4  | 62.1  | 52.5  | 59.8  | 68.9  | 64.5        | 428             | 2023/02/07/776  |                |
| 20 | ES Leo    | 5.46 - 5.58    | Hp    | M1 III C    |           | 1.0   | 37.6  | 46.3  | 43.7  | 66.3  | 58.8  | 63.9  | 76.8  | 73.3        | 467             | 2023/02/07/781  |                |
| 21 | 75 Cyg    | 5.11 V         |       | M1 IIIab C  |           | 1.0   | 32.5  | 40.8  | 37.2  | 56.4  | 47.9  | 68.3  | 59.1  | 60.9        | 403             | 2023/04/15/817  |                |
| 22 | V362 Aur  | 7.09 - 7.73    | V     | M1 5Ib C    | 1.5       | 40.6  | 47.7  | 59.5  | 68.8  | 53.2  | 73.7  | 72.8  | 73.1  | 489         | 2023/02/14/512  |                 |                |
| 23 | φ Aqr     | 4.3 - 4.33     | V     | M1.5 III C  |           | 1.5   | 34.5  | 44.9  | 42.0  | 66.2  | 58.3  | 86.2  | 67.5  | 73.9        | 474             | 2023/07/23/790  |                |
| 24 | CF Cyg    | 5.3 - 5.37     | V     | M1.5 III C  |           | 1.5   | 36.8  | 42.2  | 42.5  | 66.2  | 59.1  | 77.7  | 74.1  | 74.5        | 474             | 2023/07/23/795  |                |
| 25 | ζ Cet     | 5.14 - 5.18    | V     | M1.5 Ib C   |           | 1.5   | 30.8  | 38.9  | 36.4  | 54.7  | 50.4  | 65.8  | 56.7  | 57.2        | 383             | 2023/09/18/784  |                |
| 26 | μ Oph     | 3.45 - 5.1     | V     | M2-1a C     |           | 2.0   | 44.6  | 56.2  | 74.3  | 78.9  | 69.0  | 88.0  | 11.0  | 97.7        | 623             | 2023/03/28/813  |                |
| 27 | ST Cap    | 7.8 - 8.8      | V     | M2-1ab C    |           | 2.0   | 51.3  | 61.2  | 70.4  | 82.2  | 77.9  | 97.9  | 113.0 | 102.0       | 656             | 2023/04/29/806  |                |
| 28 | T Per     | 8.3 - 9.9      | V     | M2-1ab C    |           | 2.0   | 40.4  | 46.7  | 58.5  | 72.1  | 57.9  | 76.5  | 74.7  | 77.1        | 504             | 2023/02/08/479  |                |
| 29 | NO Aqr    | 6.05 - 6.59    | V     | M2-1ab C    |           | 2.0   | 40.0  | 45.7  | 55.9  | 67.9  | 55.7  | 76.7  | 75.9  | 76.5        | 494             | 2023/02/14/428  |                |
| 30 | V407 Pup  | 6.89 - 7.78    | V     | M2-1ab C    |           | 2.0   | 59.3  | 67.7  | 81.9  | 94.6  | 79.4  | 97.1  | 124.0 | 113.0       | 719             | 2023/02/16/534  |                |
| 31 | UW Aqr    | 8.57 - 9.30    | V     | M2-1ab C    |           | 2.0   | 47.2  | 55.1  | 69.9  | 78.1  | 68.1  | 92.1  | 104.0 | 88.6        | 603             | 2023/06/09/750  |                |
| 32 | V366 Aqr  | 6.74 - 6.93    | Hp    | M2-1b C     |           | 2.0   | 40.4  | 48.5  | 58.7  | 73.4  | 65.7  | 68.8  | 73.5  | 87.3        | 516             | 2023/07/20/798  |                |
| 33 | V419 Cep  | 6.44 - 6.89    | V     | M2II C      |           | 2.0   | 46.4  | 53.6  | 65.9  | 78.3  | 68.0  | 87.1  | 97.1  | 93.9        | 590             | 2023/04/26/808  |                |
| 34 | BE Cam    | 4.35 - 4.52    | V     | M2II C      |           | 2.0   | 43.8  | 50.0  | 51.7  | 76.8  | 74.7  | 96.9  | 96.5  | 90.7        | 581             | 2023/09/11/792  |                |
| 35 | FZ Vir    | 6.81 - 6.98    | V     | M2II C      |           | 2.0   | 56.6  | 66.0  | 67.9  | 100.0 | 95.9  | 115.0 | 129.0 | 112.0       | 742             | 2023/07/02/795  |                |
| 36 | HD17651   | 8.28 - 8.32    | Hp    | M2II C      |           | 2.0   | 49.1  | 57.2  | 65.5  | 80.5  | 74.0  | 102.0 | 101.0 | 102.0       | 603             | 2023/02/08/229  |                |
| 37 | 70 Vir    | 3.44 - 3.48    | V     | M2II C      |           | 2.0   | 35.5  | 46.8  | 59.1  | 69.1  | 74.4  | 71.7  | 71.6  | 65.9        | 2023/03/26/679  |                 |                |
| 38 | V528 Lyr  | 6.83 V (0.15)H |       | M2II C      |           | 2.0   | 40.0  | 50.6  | 48.7  | 72.0  | 66.6  | 86.5  | 86.1  | 82.7        | 535             | 2023/03/19/850  |                |
| 39 | V771 Mon  | 8.15 - 8.28    | Hp    | M2II C      |           | 2.0   | 46.5  | 55.5  | 53.1  | 82.5  | 80.1  | 102.0 | 107.0 | 97.0        | 624             | 2023/03/23/460  |                |
| 40 | IO UMa    | 4.69 - 4.75    | Hp    | M2II C      |           | 2.0   | 35.6  | 43.1  | 44.4  | 69.5  | 59.3  | 78.4  | 76.8  | 71.9        | 479             | 2023/02/04/785  |                |
| 41 | TT Crv    | 6.47 - 6.87    | V     | M2II C      |           | 2.0   | 53.5  | 63.2  | 62.8  | 94.5  | 90.8  | 110.0 | 123.0 | 112.0       | 711             | 2023/02/11/786  |                |
| 42 | HD83893   | 7.18 - 7.27    | Hp    | M2II C      |           | 2.0   | 36.6  | 45.4  | 41.2  | 64.3  | 60.9  | 81.3  | 78.8  | 77.5        | 486             | 2023/03/28/506  |                |
| 43 | HD87955   | 7.85 (0.021)   | V     | M2II C      |           | 2.0   | 42.4  | 55.1  | 46.0  | 70.0  | 76.0  | 97.5  | 103.0 | 93.7        | 584             | 2023/04/03/435  |                |
| 44 | η Gem     | 3.1 - 3.7      | V     | M2II C      |           | 2.0   | 44.8  | 53.1  | 56.5  | 85.9  | 77.2  | 96.0  | 108.0 | 98.0        | 120             | 420             | 2023/02/14/497 |
| 45 | ET Vir    | 4.8 - 5.9      | V     | M2IIa C     |           | 2.0   | 32.6  | 44.6  | 42.4  | 58.6  | 50.9  | 84.7  | 78.4  | 69.8        | 462             | 2023/06/16/558  |                |
| 46 | δ Lib     | 3.2 - 3.48     | V     | M2 III B    | 2.5       | 47.8  | 59.9  | 56.9  | 81.4  | 79.7  | 103.0 | 109.0 | 105.0 | 643         | 2023/07/11/465  |                 |                |
| 47 | V1472 Ad  | 5.03 - 6.51    | V     | M2 III C    | 2.5       | 30.8  | 46.3  | 44.5  | 64.5  | 60.2  | 85.4  | 92.1  | 92.1  | 514         | 2023/03/01/512  |                 |                |
| 48 | WZ Vir    | 7.63 V (0.1)   | V     | M2 III C    | 2.5       | 39.2  | 50.0  | 49.5  | 85.7  | 86.1  | 96.1  | 98.1  | 91.5  | 503         | 2023/03/01/513  |                 |                |
| 49 | WW Peg    | 5.07 - 5.11    | V     | M2 III C    | 2.5       | 47.7  | 54.1  | 54.8  | 70.4  | 75.3  | 94.4  | 103.0 | 96.7  | 600         | 2023/07/23/771  |                 |                |
| 50 | PZ Cas    | 8.15 - 8.28    | V     | M2 IIIa C   | 3.0       | 60.5  | 67.6  | 62.6  | 82.7  | 81.4  | 101.0 | 126.0 | 113.0 | 719         | 2023/06/20/784  |                 |                |
| 51 | PZ Cas    | 8.2 - 10.3     | V     | M2 IIIa C   | 3.0       | 60.4  | 67.6  | 77.3  | 82.6  | 79.8  | 101.0 | 131.0 | 116.0 | 716         | 2023/07/23/779  |                 |                |
| 52 | AD Per    | 7.7 - 8.4      | V     | M2Iab C     | 3.0       | 50.5  | 58.1  | 70.4  | 83.0  | 71.8  | 91.5  | 107.3 | 97.4  | 634         | 2023/02/08/482  |                 |                |
| 53 | V441 Per  | 8.19 - 8.85    | V     | M2Iab C     | 3.0       | 55.4  | 63.3  | 72.6  | 92.3  | 84.2  | 105.2 | 120.3 | 110.5 | 704         | 2023/02/08/501  |                 |                |
| 54 | η Cet     | 8.7 - 10.9     | V     | M2Iab C     | 3.0       | 58.7  | 64.6  | 75.7  | 92.0  | 80.5  | 94.4  | 118.0 | 100.0 | 684         | 2023/05/23/788  |                 |                |
| 55 | TZ Cas    | 8.7 - 10.7     | V     | M2Iab C     | 3.0       | 62.7  | 69.1  | 76.1  | 87.4  | 82.4  | 106.0 | 129.0 | 115.0 | 732         | 2023/07/09/791  |                 |                |
| 56 | η Aur     | 4.24 - 4.34    | V     | M2IIIb C    | 3.0       | 59.5  | 67.8  | 71.8  | 99.5  | 101.0 | 115.0 | 131.0 | 121.0 | 767         | 2023/03/14/448  |                 |                |
| 57 | γ Vir     | 4.75 - 5.10    | V     | M2III C     | 3.0       | 71.2  | 70.8  | 76.7  | 114.0 | 114.0 | 127.0 | 150.0 | 141.0 | 872         | 2023/07/25/763  |                 |                |
| 58 | ψ Peg     | 4.63 - 4.69    | V     | M2III C     | 3.0       | 46.5  | 55.0  | 53.3  | 87.6  | 82.0  | 102.0 | 109.0 | 107.0 | 642         | 2023/07/25/766  |                 |                |
| 59 | PS Vir    | 4.37 - 4.52    | V     | M2III C     | 3.0       | 60.7  | 66.5  | 102.0 | 122.0 | 123.0 | 128.0 | 130.0 | 130.0 | 773         | 2023/02/07/805  |                 |                |
| 60 | YY Peg    | 4.31 - 5.42    | V     | M2III C     | 3.0       | 54.8  | 64.1  | 62.8  | 91.9  | 92.0  | 124.0 | 138.0 | 134.0 | 752         | 2023/07/23/767  |                 |                |
| 61 | WZ Vir    | 6.90 - 7.11    | V     | M2III C     | 3.0       | 53.6  | 63.0  | 83.0  | 92.7  | 91.7  | 110.0 | 122.0 | 111.0 | 708         | 2023/04/17/482  |                 |                |
| 62 | HD82418   | 6.80 - 6.91    | V     | M2III C     | 3.0       | 49.0  | 57.0  | 56.9  | 87.8  | 84.4  | 101.0 | 111.0 | 99.9  | 647         | 2023/03/13/455  |                 |                |
| 63 | V394 Aur  | 6.00 - 6.11    | V     | M2III C     | 3.0       | 73.4  | 74.5  | 74.6  | 110.0 | 108.0 | 124.0 | 132.0 | 110.0 | 608         | 2023/02/04/872  |                 |                |
| 64 | W Leo     | 6.84 - 6.93    | Hp    | M4 II B     | 4.0       | 64.4  | 75.4  | 74.5  | 116.0 | 108.0 | 124.0 | 132.0 | 110.0 | 715         | 2023/04/03/502  |                 |                |
| 65 | z Leo     | 8.95 - 8.97    | V     | M4 III C    | 4.0       | 64.7  | 69.5  | 69.4  | 122.0 | 121.0 | 180.0 | 166.0 | 167.0 | 1034        | 2023/07/25/743  |                 |                |
| 66 | LP Agr    | 8.30 - 8.64    | V     | M4 III C    | 4.0       | 79.3  | 88.7  | 88.9  | 123.0 | 128.0 | 141.0 | 178.0 | 154.0 | 980         | 2023/07/25/746  |                 |                |
| 67 | RX LM     | 5.98 - 6.16    | V     | M4 III B    | 4.0       | 107.0 | 113.0 | 124.0 | 145.0 | 130.0 | 146.0 | 191.0 | 183.0 | 1139        | 2023/04/03/444  |                 |                |
| 68 | VI293 Agr | 6.45 - 6.81    | V     |             |           |       |       |       |       |       |       |       |       |             |                 |                 |                |

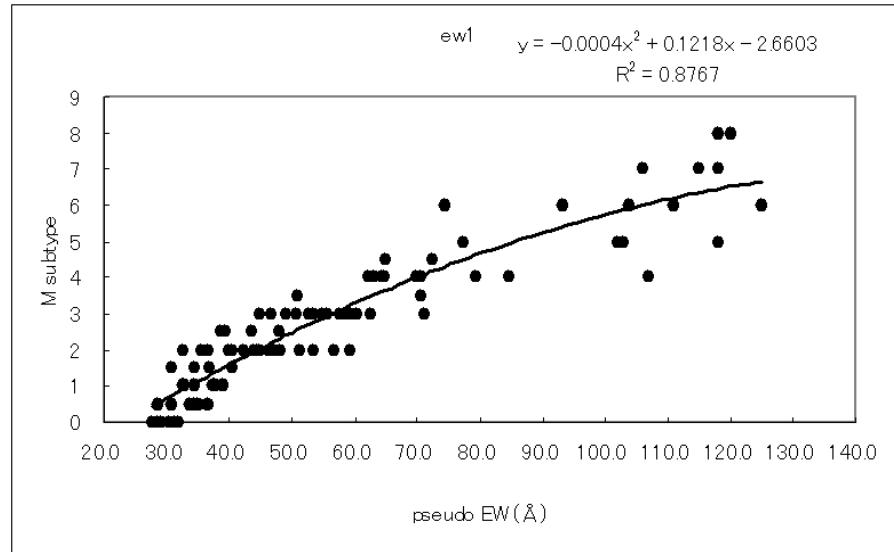
| M型サブタイプ | サンプル数 |
|---------|-------|
| M0      | 6     |
| M0.5    | 7     |
| M1      | 8     |
| M1.5    | 4     |
| M2      | 20    |
| M2.5    | 4     |
| M3      | 14    |
| M3.5    | 2     |
| M4      | 10    |
| M4.5    | 2     |
| M5      | 4     |
| M6      | 6     |
| M7      | 3     |
| M8      | 2     |

表2 サブタイプ別サンプル数

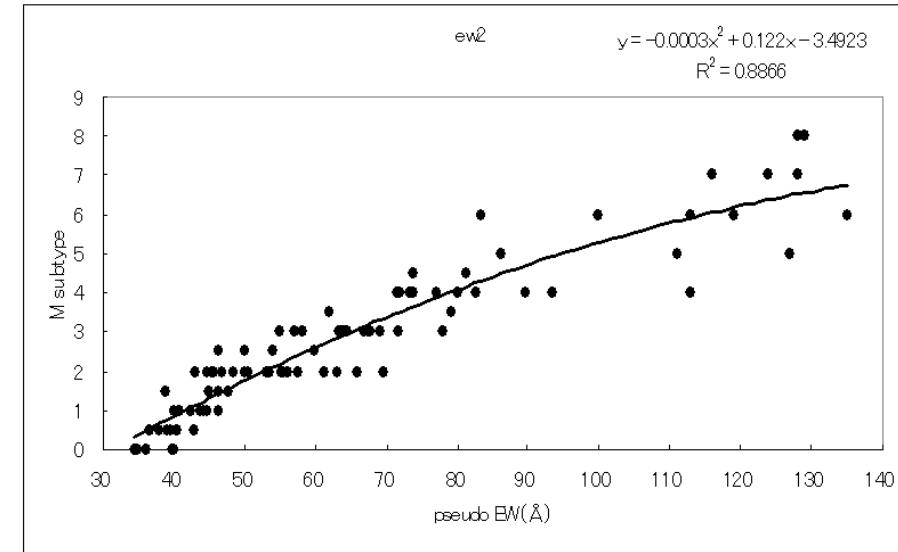
| 光度階級     | サンプル数 |
|----------|-------|
| Ia       | 3     |
| Ia-Iab   | 1     |
| Iab      | 11    |
| Iab-Ib   | 1     |
| Iab-Fe-1 | 1     |
| Ib       | 4     |
| Ib-IIa   | 1     |
| Ib-II    | 1     |
| IIb      | 1     |
| II       | 3     |
| IIIa     | 4     |
| IIIab    | 2     |
| IIIb     | 2     |
| III      | 55    |
| IIIv     | 1     |
| III-IV   | 1     |

表3 光度階級別サブタイプ数

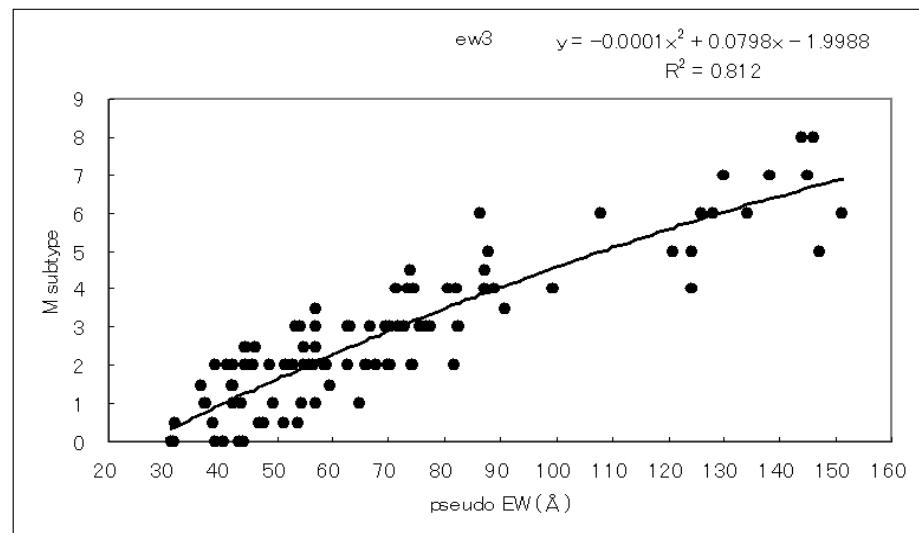
以下の図2にew1～ew8の疑似等価幅 vs サブタイプグラフと2次近似式を示す。  
また図3にew1～ew8の疑似等価幅合計 vs サブタイプグラフと2次近似式を示す。



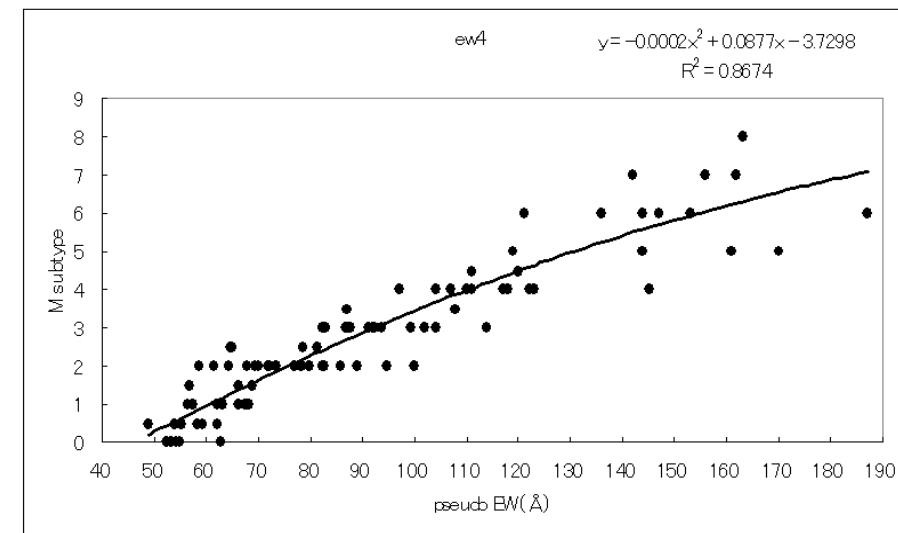
ew1: 4945-5150A



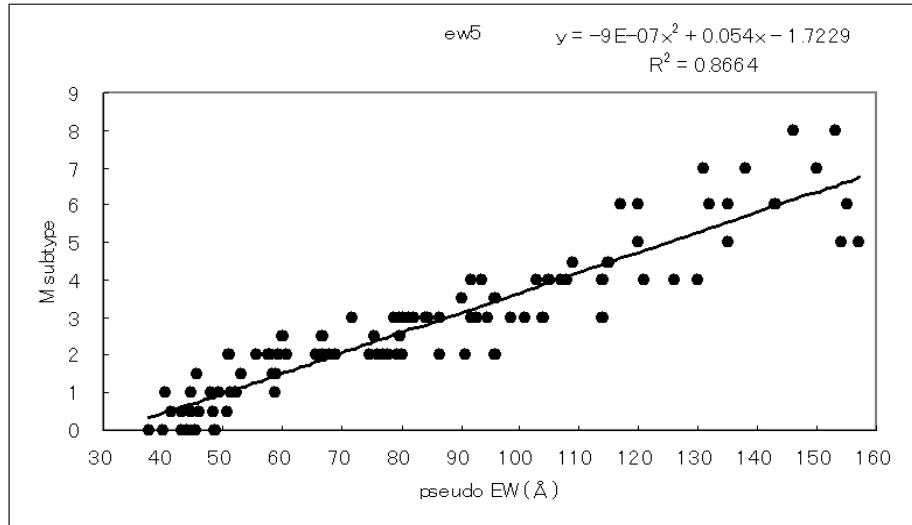
ew2: 5150-5435A



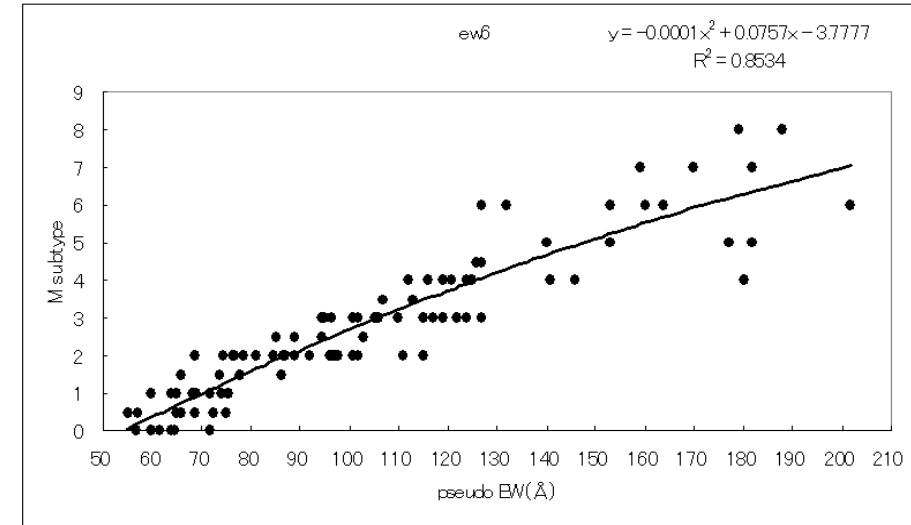
ew3: 5435-5800A



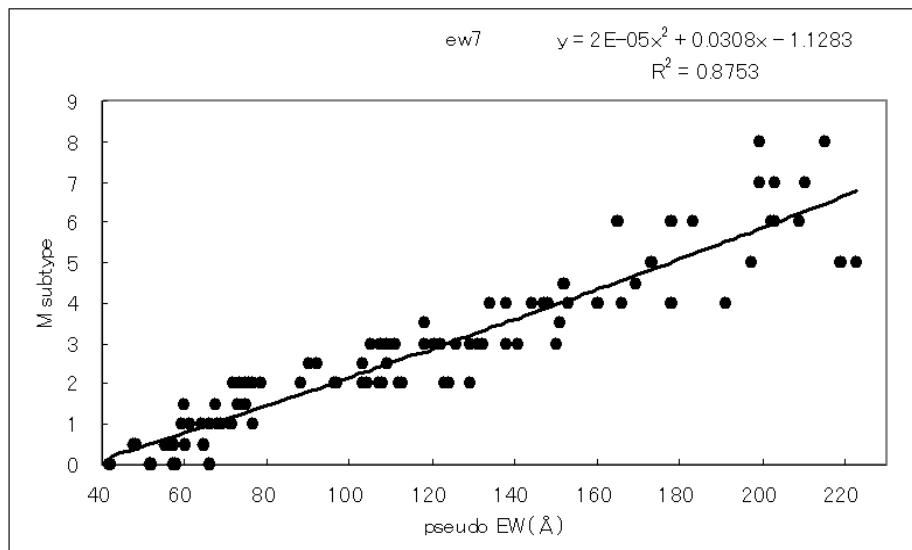
ew4: 5800-6100A



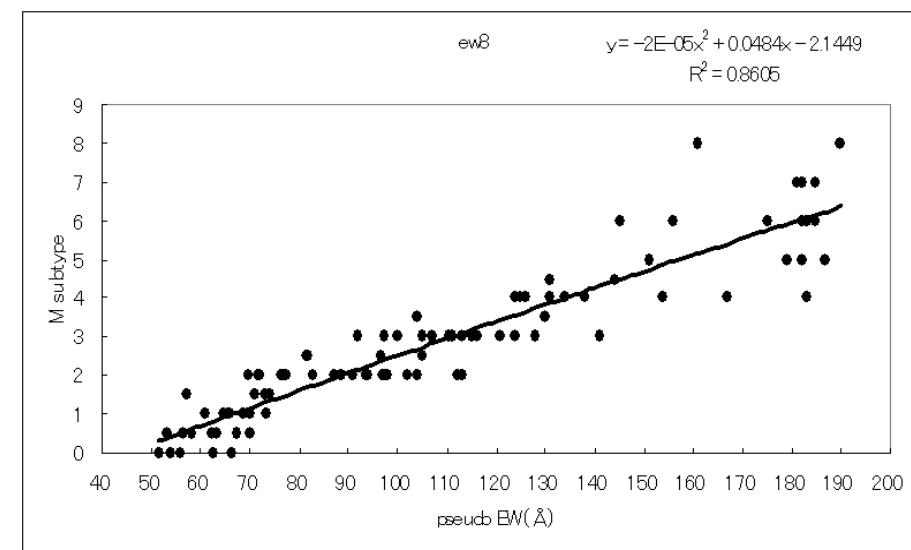
ew5: 6150-6400A



ew6: 6540-6970A



ew7: 7050-7400A



ew8: 7580-8080A

図2 ew1-ew8 疑似等価幅 vs サブタイプ 及び2次近似式

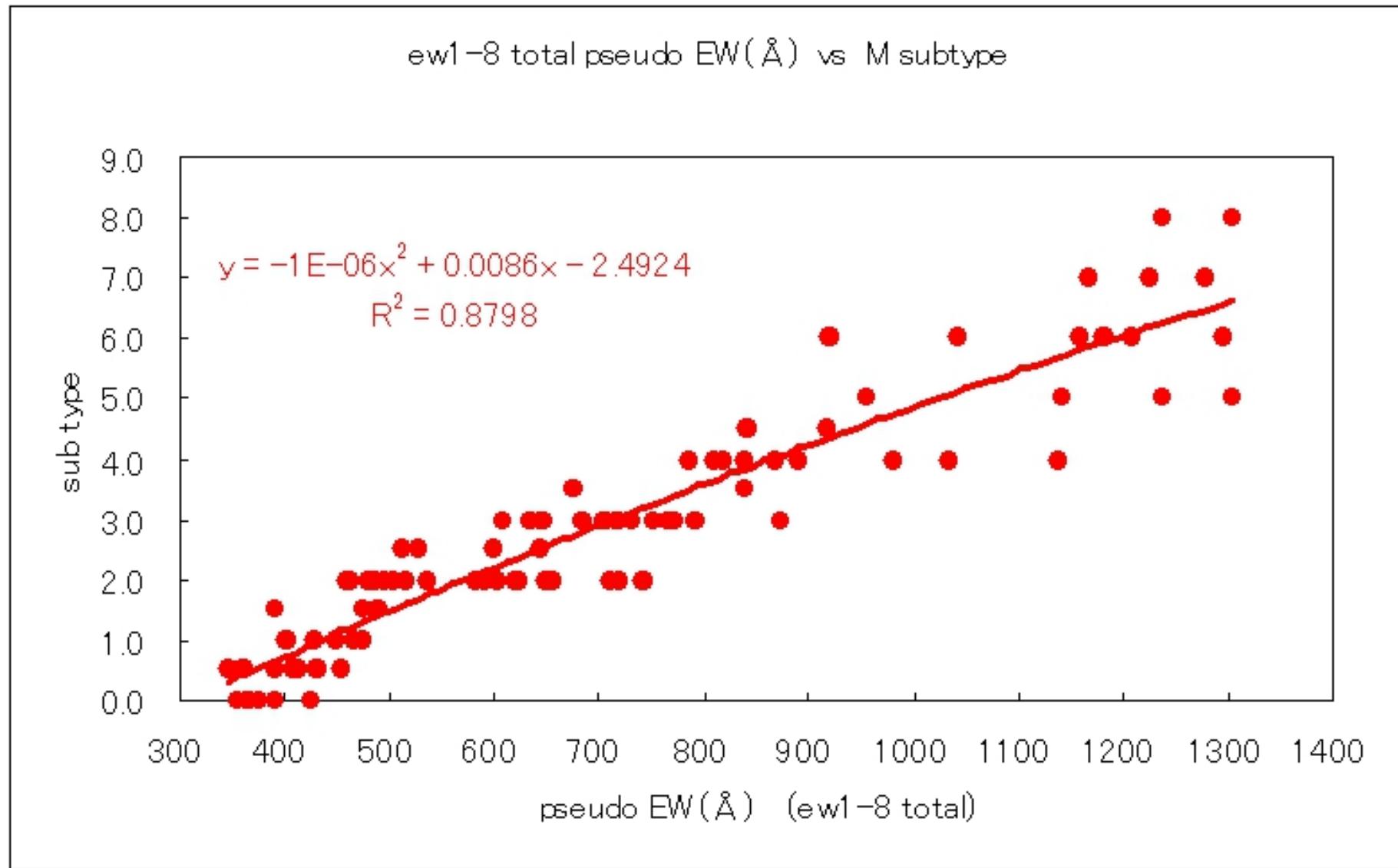


図3 ew1～ew8を合計した疑似等価幅 vs サブタイプ

|       | 2次近似式                               | (決定係数) $R^2$ |
|-------|-------------------------------------|--------------|
| ew1   | $Y = -0.0004X^2 + 0.1213X - 2.6603$ | 0.88         |
| ew2   | $Y = -0.0003X^2 + 0.122X - 3.4923$  | 0.89         |
| ew3   | $Y = -0.0001X^2 + 0.0798X - 1.9988$ | 0.81         |
| ew4   | $Y = -0.0002X^2 + 0.0877X - 3.7298$ | 0.87         |
| ew5   | $Y = -9E-07X^2 + 0.054X - 1.7229$   | 0.87         |
| ew6   | $Y = -0.0001X^2 + 0.0757X - 3.7777$ | 0.85         |
| ew7   | $Y = 2E-05X^2 + 0.0308X - 1.1283$   | 0.88         |
| ew8   | $Y = -2E-05X^2 + 0.0484X - 2.1449$  | 0.86         |
| ew1~8 | $Y = -1E-6X^2 + 0.0086X - 2.4924$   | 0.88         |

表4 各ew値の2次近似式と決定係数 $R^2$

ここでM型星のサブタイプ推定は次のew1~ew8の合計値を用いて得られた2次近似式(表4の赤色)を用いることにする。

**sub = -1E-6x<sup>2</sup> + 0.0086x - 2.4924 ⋯ (a)**      sub: サブタイプ      x: ew1~ew8 合計

次に(a)式で得られたサブタイプ値より有効温度を推定する。

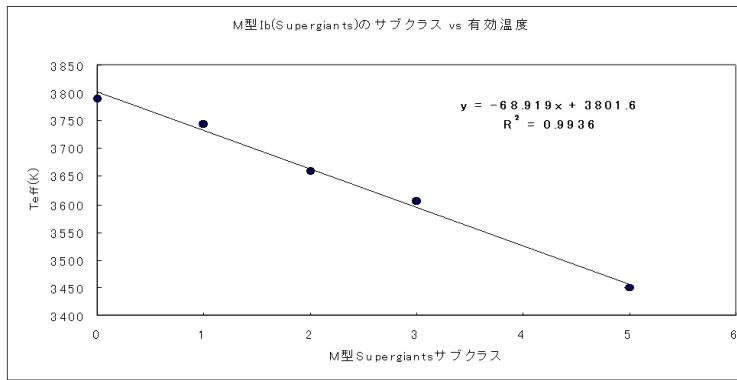
ここで R.O.Gray STELLAR SPECTRAL CLASSIFICATION P.568 Table B.4 よりM型サブタイプ vs 有効温度の近似式を作成した。

この文献では表5のように光度階級 Ib, III, Vの3種の有効温度が示されている。

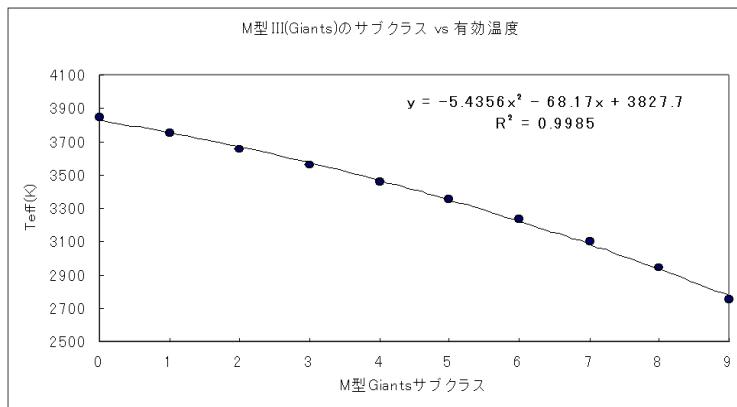
| M型サブタイプ | Ib: Supergiants | M型サブタイプ | III: Giants | M型サブタイプ | V: Dwarfs |
|---------|-----------------|---------|-------------|---------|-----------|
| 0       | 3790 K          | 0       | 3845 K      | 0       | 3759 K    |
| 1       | 3745 K          | 1       | 3750 K      | 1       | 3624 K    |
| 2       | 3660 K          | 2       | 3655 K      | 2       | 3489 K    |
| 3       | 3605 K          | 3       | 3560 K      | 3       | 3354 K    |
| 5       | 3450 K          | 4       | 3460 K      | 4       | 3219 K    |
|         |                 | 5       | 3355 K      | 5       | 3084 K    |
|         |                 | 6       | 3240 K      | 6       | 2949 K    |
|         |                 | 7       | 3100 K      | 7       | 2814 K    |
|         |                 | 8       | 2940 K      | 8       | 2679 K    |
|         |                 | 9       | 2755 K      | 9       | 2544 K    |

表5 R.O.Gray STELLAR SPECTRAL CLASSIFICATION P.568 Table B.4 より

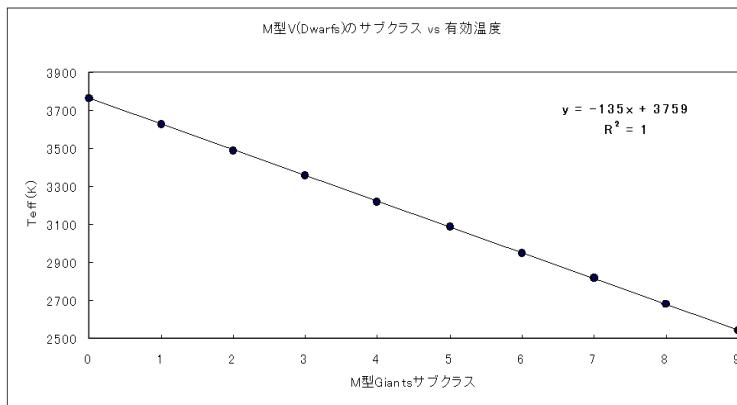
図4に各光度階級 vs 有効温度のグラフと近似式を示す。



**M Ib (Supergiants):  $Teff = -68.919(\text{sub}) + 3801.6$   $R^2 = 0.9936$**



**M III (Giants):  $Teff = -5.4356(\text{sub})^2 - 68.17(\text{sub}) + 3827.7$   $R^2 = 0.9936$**



**M V (Dwarfs):  $Teff = -135(\text{sub}) + 3759$   $R^2 = 1$**

(sub) : (a)式より

図4 M型サブタイプ vs 有効温度

## 懸念事項：

この疑似等価幅測定によるM型星サブクラス及び有効温度推定は、正規の等価幅測定とは異なり広い波長範囲を積分しているので、星間赤化の影響を大きく受けている遠方のM型星やガス・ダストの濃い領域に存在するM型星には通用しないのでは？という懸念がある。

## 参考文献

R.O.Gray STELLAR SPECTRAL CLASSIFICATION