SOME MULTIPLETS IN THE Ag III SPECTRUM.*

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The present paper deals with the identification of the fundamental multiplets of the Ag III spectrum with the aid of the Moseley diagrams for the terms of the isoelectronic sequence Rh I, Pd II and Ag III. An investigation on similar lines has enabled the author to identify the fundamental multiplets of the Cu III spectrum. The spark spectrum of Silver in the extreme Ultra-violet has been photographed and wave-lengths determined by Handke, Eder, Shenstone, and L. & E. Bloch. The method of excitation adopted by L. & E. Bloch is particularly favourable for the photographing of the second and higher spark spectra of Silver. Accordingly their data have been mainly utilised in the present work. Sommer has analysed the spectrum of Rh I and Shenstone the spectrum of Pd II. In the construction of the Moseley diagrams their data for Rh I and Pd II have been utilised.

Table I gives the spectral terms corresponding to the configurations 4d°, 4d65s, and 4d65p of Ag III together with their limits.

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Spectral terms</th>
<th>Limits</th>
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<tbody>
<tr>
<td>4d°</td>
<td>2(D)</td>
<td>1(D)</td>
</tr>
<tr>
<td></td>
<td>4(F) 6(F)</td>
<td>4(F)</td>
</tr>
<tr>
<td></td>
<td>4(P) 6(P)</td>
<td>4(P)</td>
</tr>
<tr>
<td>4d65s</td>
<td>7(G)</td>
<td>7(G)</td>
</tr>
<tr>
<td></td>
<td>7(D)</td>
<td>7(D)</td>
</tr>
<tr>
<td></td>
<td>7(S)</td>
<td>7(S)</td>
</tr>
<tr>
<td>4d65p</td>
<td>1(GFD) 2(GFD)</td>
<td>1(GFD)</td>
</tr>
<tr>
<td></td>
<td>1(DPS) 2(DPS)</td>
<td>1(DPS)</td>
</tr>
<tr>
<td></td>
<td>1(HGF)</td>
<td>1(HGF)</td>
</tr>
<tr>
<td></td>
<td>1(FDP)</td>
<td>1(FDP)</td>
</tr>
<tr>
<td></td>
<td>1(FS)</td>
<td>1(FS)</td>
</tr>
</tbody>
</table>

* A short abstract of a paper by Gibbs and White [Phys. Rev., 32, p. 318, 1928, (A)], read before the American Physical Society, has recently come to the notice of the author, but a careful search in the Science Abstracts and Physikalische Berichte failed to show whether the work had been completed and published.

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Of these only the terms $4d^8(3F)5s \, ^4F$ & $^2F$ and $4d^8(3F)5p \, ^4F'$ & $^2F'$ have been identified since lines resulting from the combination of these two sets of terms are the strongest while those resulting from intercombinations are relatively weak.

Table II.

<table>
<thead>
<tr>
<th></th>
<th>Rh I</th>
<th>Pd II</th>
<th>Ag III</th>
</tr>
</thead>
<tbody>
<tr>
<td>$4d^8(3F)5s$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$^4F'_{3/2}$</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>$^4F'_{1/2}$</td>
<td>1530.0</td>
<td>2013.3</td>
<td>2317.0</td>
</tr>
<tr>
<td>$^4F_{7/2}$</td>
<td>1068.1</td>
<td>1832.7</td>
<td>2641.0</td>
</tr>
<tr>
<td>$^4F'_{5/2}$</td>
<td>2598.1</td>
<td>3816.0</td>
<td>4958.0</td>
</tr>
<tr>
<td>$^4F_{9/2}$</td>
<td>874.6</td>
<td>1018.6</td>
<td>1004.0</td>
</tr>
<tr>
<td>$^2F'_{3/2}$</td>
<td>5890.0</td>
<td>7196.9</td>
<td>8452.0</td>
</tr>
<tr>
<td>$^2F_{5/2}$</td>
<td>2100.3</td>
<td>2144.1</td>
<td>1632.0</td>
</tr>
<tr>
<td>$4d^8(3F)5p$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$^4F'_{9/2}$</td>
<td>7791.2</td>
<td>9341.0</td>
<td>10084.0</td>
</tr>
<tr>
<td>$^4F'_{7/2}$</td>
<td>29431.1</td>
<td>44797.4</td>
<td>59053.0</td>
</tr>
<tr>
<td>$^4F'_{5/2}$</td>
<td>29866.5</td>
<td>46163.7</td>
<td>61806.0</td>
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<tr>
<td>$^4F'_{3/2}$</td>
<td>31474.8</td>
<td>48031.4</td>
<td>59006.0</td>
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<td>$^2F'_{7/2}$</td>
<td>32277.6</td>
<td>47267.0</td>
<td>60693.0</td>
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<tr>
<td>$^2F'_{5/2}$</td>
<td>32004.1</td>
<td>48246.5</td>
<td>63484.0</td>
</tr>
<tr>
<td>$^2F'_{3/2}$</td>
<td>33946.5</td>
<td>50672.6</td>
<td>65558.0</td>
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</table>

The term values of the multiplets of Rh I, Pd II and Ag III with their multiplet separations are given in Table II. The term $4d^8(3F)5s \, ^4F_{9/2}$ is taken as zero. As is to be expected it is found that the multiplet separations increase on moving from Rh I to Pd II and then from Pd II to Ag III.
The multiplet scheme for the quartets and the doublets of the configurations 4d⁵5s and 4d⁵5p of Ag III is given in Table III. It is found that the intensity rules are satisfied and the super-multiplets are formed in the right manner. It is only in the case of lines arising from intercombinations that three lines are missing and these lines are expected to be comparatively of low intensity according to theory.

![Moseley-diagram of the isoelectronic sequence Rh I, Pd II and Ag III.](image-url)
The Moseley diagrams for the terms of the Rh I, Pd II and Ag III sequence given in Fig. 1 confirms the present identification of the terms of Ag III. Since the absolute value of the lowest state for Rh I is about 623700.0 cm⁻¹ and that for Pd II about 160600.0 cm⁻¹, both of them with respect to the term 4d⁸ 3F of the next ion⁸ the absolute value of the 4d⁸5s ⁴F⁵/₂ term of Ag III comes out as 237000.0 cm⁻¹ corresponding to an ionisation potential of about 29.25 volts.

Table IV gives the √{\frac{\nu}{\alpha}} values for the terms of the members Rh I, Pd II and Ag III isoelectronic sequence, with their differences which are found to be regular throughout the sequence.

**Table IV.**

<table>
<thead>
<tr>
<th>Terms</th>
<th>Rh I</th>
<th>Difference</th>
<th>Pd II</th>
<th>Difference</th>
<th>Ag III</th>
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</thead>
<tbody>
<tr>
<td>⁴F₀/₂</td>
<td>0.754</td>
<td>(0.357)</td>
<td>1.111</td>
<td>(0.358)</td>
<td>1.469</td>
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<tr>
<td>⁴F₁/₂</td>
<td>0.745</td>
<td>(0.358)</td>
<td>1.103</td>
<td>(0.358)</td>
<td>1.461</td>
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<tr>
<td>⁴F₂/₂</td>
<td>0.738</td>
<td>(0.362)</td>
<td>1.100</td>
<td>(0.353)</td>
<td>1.453</td>
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<tr>
<td>⁴F₃/₂</td>
<td>0.733</td>
<td>(0.358)</td>
<td>1.091</td>
<td>(0.359)</td>
<td>1.450</td>
</tr>
<tr>
<td>⁴F₄/₂</td>
<td>0.719</td>
<td>(0.362)</td>
<td>1.081</td>
<td>(0.361)</td>
<td>1.442</td>
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<tr>
<td>⁴F₅/₂</td>
<td>0.705</td>
<td>(0.367)</td>
<td>1.072</td>
<td>(0.365)</td>
<td>1.437</td>
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<tr>
<td>⁴F₀/₂</td>
<td>0.548</td>
<td>(0.361)</td>
<td>0.909</td>
<td>(0.363)</td>
<td>1.272</td>
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<tr>
<td>⁴F₁/₂</td>
<td>0.544</td>
<td>(0.359)</td>
<td>0.903</td>
<td>(0.359)</td>
<td>1.262</td>
</tr>
<tr>
<td>⁴F₂/₂</td>
<td>0.531</td>
<td>(0.372)</td>
<td>0.903</td>
<td>(0.369)</td>
<td>1.272</td>
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<tr>
<td>⁴F₃/₂</td>
<td>0.524</td>
<td>(0.373)</td>
<td>0.897</td>
<td>(0.369)</td>
<td>1.266</td>
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<tr>
<td>⁴F₄/₂</td>
<td>0.526</td>
<td>(0.366)</td>
<td>0.892</td>
<td>(0.364)</td>
<td>1.256</td>
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<tr>
<td>⁴F₅/₂</td>
<td>0.509</td>
<td>(0.370)</td>
<td>0.879</td>
<td>(0.370)</td>
<td>1.249</td>
</tr>
<tr>
<td>⁴F₀/₂</td>
<td>0.509</td>
<td>(0.370)</td>
<td>0.879</td>
<td>(0.370)</td>
<td>1.249</td>
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The list of lines classified in the present investigation is given in Table V.
<table>
<thead>
<tr>
<th>Observer</th>
<th>Intensity</th>
<th>Wavelength</th>
<th>Wavenumber</th>
<th>Designation</th>
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<tr>
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<td></td>
<td>Observed</td>
<td>Calculated</td>
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<td>1</td>
<td>1976·28</td>
<td>50600·1</td>
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<td>Shenstone</td>
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<td>1932·88</td>
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<td>L. &amp; E. Bloch</td>
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<td>1885·20</td>
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<td>1826·91</td>
<td>54730·9</td>
<td>54730·0</td>
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<td></td>
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<td>55477·9</td>
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<td>2</td>
<td>1764·13</td>
<td>56685·2</td>
<td>56689·0</td>
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<td>Handke</td>
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<td>1758·89</td>
<td>56854·0</td>
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<td>1693·36</td>
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<td>59053·0</td>
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<td>1680·83</td>
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<td>1</td>
<td>1575·30</td>
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<td>63484·0</td>
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</table>
Some Multiplets in the Ag III Spectrum

Summary.

By a consideration of the isoelectronic sequence Rh I, Pd II and Ag III, the terms $4d^8(5F)5s\ 4F$ & $2F$ and $4d^8(5F)5p\ 4F'$ & $2F'$ of Ag III have been identified. The Moseley diagram for the corresponding terms of the members of the sequence is also given in the paper. The absolute value of the term $4d^8(5F)5s\ 4F_{9/2}$ comes out as equal to $237000.0\ \text{cm}^{-1}$ corresponding to an ionisation potential of about 29.25 volts.

REFERENCES.

2 Handke, see Kayser's Handbuch der Spectroscopie, VII.
3 Eder, Ibid.
5 L. & F. Bloch, Journ. de Phys., 6, p. 154, 1925.