

Observation and interpretation of $4f^{12}$ - $4f^{11}5d$ transitions in the Tm^{3+} free ion spectrum

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The present work is the first interpretation of triply ionised thulium spectrum. About 300 lines have been identified as transitions from 95 levels of $4f^{11}5d$ to 10 levels of the $4f^{12}$ ground configuration in the free ion Tm^{3+} . The spectrum of thulium has been recorded in the 800-1800Å wavelength region on the 10.7 m VUV normal incidence spectrograph at the Paris-Meudon Observatory. This instrument is equipped with a 3600 lines/mm holographic grating and provides a unique plate factor of 0.25Å/mm in the first order. The ionised thulium spectrum in emission was obtained using a vacuum sliding spark source with an anode of pure thulium. To vary the discharge conditions, a self-inductance coil was placed in series with the spark source. For each wavelength region, three exposures were recorded with three values of the inductance ($63\mu F$, $38\mu F$, $11\mu F$). The wavelengths calibration used known wavelengths of impurities present in spark, namely C, O, Si, Al. The estimated error of 0.003Å on the wavelengths of unperturbed lines was later confirmed by the wavenumber consistency of the classified $TmIV$ array $4f^{12}$ - $4f^{11}5d$.

The analysis was guided by predicted energy level values and transitions probabilities calculated by means of the methods and codes by Cowan [1]. Fitted parameters are consistent with those of neighbouring spectra.

[1] Cowan R.D. 1981 *The Theory of Atomic Structure and Spectra* Univ. of Calif. Press, Berkeley