

Wavelengths, Energy Levels, Hyperfine Structure and Oscillator Strength Measurement of Sc I and Sc II

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The precise observation of Sc-Ar, Sc-Ne and Sc-Ge hollow cathode emission spectrum have been made in the region 185 -3500 nm ($54,055\text{ cm}^{-1}$ - 2857 cm^{-1}) by Fourier transform (FT) spectroscopy, and in the region 80 - 410 nm ($125,000\text{ cm}^{-1}$ - $24,390\text{ cm}^{-1}$) using a 10.7 m grating spectrograph at National Institute of Standards and Technology (NIST). We measured more than 1650 lines in Sc I and Sc II and used them to derive optimized values for 240 energy levels. The measurements using FT spectroscopy show significant hyperfine structure (HFS) patterns for more than 300 lines. These were fitted using the computer package XGREMLIN [1] to determine the magnetic dipole hyperfine interaction constant A for 102 levels, of which 57 have no previous HFS constants. We also determine approximate electric quadruple HFS constant B for several levels. The same spectra were used to measure the branching fractions and transition probabilities for 258 lines in Sc I and Sc II [2] and combined with new complete HFS component patterns from HFS constants to redetermine the Sc abundance in the Sun, Arcturus, and the MP halo star HD 84937.

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References

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