

# Progress in the classification of spectral lines of Praseodymium

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In continuation of our work concerning fine structure levels of Praseodymium, we have found few new levels of Pr-I. Recently we discovered 11 new levels and were able to classify 49 spectral lines [1]. When investigating spectral lines of Pr in a Fourier transform spectrum of Pr [2] we found a new line of Pr with wavelength 9857.664 Å. This spectral line is reported first time here. Though the signal-to-noise ratio (SNR) of this line is not high, the hyperfine (hf) structure of the lines clearly indicates that it could be a transition between levels of low angular momenta. The simulation of this line tells us that it's a  $J_o = 5/2$  to  $J_u = 5/2$  transition. For the determination of the hyperfine constants, the line was fitted with  $J_o = 5/2$  to  $J_u = 5/2$ , and we got 824.76 MHz and 1062.38 MHz. One of the known even lower levels of Pr, 14135.745  $\text{cm}^{-1}$ , was then assumed to be the lower level of the transition, as it has  $J_u = 5/2$  and an hf constant 1063.3 MHz. The addition of the wave number of the investigated spectral line to this level yields 24457.355  $\text{cm}^{-1}$  (the energy of odd upper level of the transition). Further investigations confirmed the existence of this new upper level since it is classifying four more unclassified lines. These lines are presented in Table 1.

Wavelength Å	Upper level with odd parity			Lower level with even parity			Remarks
	$J_o$	Energy/ $\text{cm}^{-1}$	$A_o/\text{MHz}$	$J_u$	Energy/ $\text{cm}^{-1}$	$A_u/\text{MHz}$	
5552.302	2.5	24457.355	820(5)	2.5	6451.808	1191	New line
8054.486	2.5	24457.355	820(5)	1.5	12051.488	1071	New line
8503.789	2.5	24457.355	820(5)	1.5	12701.121	833	New line
8823.988	2.5	24457.355	820(5)	2.5	13127.722	156	New line
9857.664	2.5	24457.355	820(5)	2.5	14135.745	1063	New line

**Table 1:** *Spectral lines of Pr - I classified by new upper level 24457.355  $\text{cm}^{-1}$ .*

## References

- [1] Zaheer Uddin, Imran Siddiqui<sup>1</sup>, Jaweria Tanweer, Saif Uddin Jilani and Laurentius Windholz J. Phys. B: At. Mol. Opt. Phys. **48**, 135001 (2015)  
[2] B. Gamper, Diploma Thesis , Graz 2007, Unpublished