

Atomic Spectroscopy

A Compendium of Basic Ideas, Notation, Data, and Formulas

17. Spectral Lines: Selection Rules, Intensities, Transition Probabilities, Values, and Line Strengths

- **Relative Strengths for Lines of Multiplets in *LS* Coupling**

This table lists relative line strengths for frequently encountered symmetrical ($P \rightarrow P, D \rightarrow D$) and normal ($S \rightarrow P, P \rightarrow D$) multiplets in *LS* coupling. The strongest, or principal, lines are situated along the main diagonal of the table and are called x_1, x_2 , etc. Their strengths normally diminish along the diagonal. The satellite lines y_n and z_n are usually weaker and deviate more from the *LS* values than the stronger diagonal lines when departures from *LS* coupling are encountered. The total multiplet strengths S_M are also listed in this table. A discussion of their normalization as well as more extensive tables are given in Ref. [30].

Relative Strengths for Lines of Multiplets in <i>LS</i> Coupling												
Normal multiplets S - P, P - D, D - F, etc.					Symmetrical multiplets P - P, D - D, etc.							
	J_m	$J_m - 1$	$J_m - 2$	$J_m - 3$	$J_m - 4$		J_m	$J_m - 1$	$J_m - 2$	$J_m - 3$		
$J_m - 1$	x_1	y_1	z_1			J_m	x_1	y_1				
$J_m - 2$		x_2	y_2	z_2		$J_m - 1$	y_1	x_2	y_2			
$J_m - 3$			x_3	y_3	z_3	$J_m - 2$		y_2	x_3	y_3		
$J_m - 4$				x_4	y_4	$J_m - 3$			y_3	x_4		
Multiplicity					Multiplicity							
	1	2	3	4	5		1	2	3	4	5	
$S_M =$	3	S - P			12	15	$S_M =$	25	D - D			125
x_1	3.00	4.00	5.00	6.00	7.00	x_1	25.00	28.00	31.11	34.29	37.50	
y_1		2.00	3.00	4.00	5.00	x_2		18.00	17.36	17.29	17.50	
z_1			1.00	2.00	3.00	x_3			11.25	8.00	6.25	
						x_4				5.00	1.25	
$S_M =$	9	P - P			36	45	y_1		2.00	3.89	5.71	7.50
x_1	9.00	10.00	11.25	12.60	14.00	y_2			3.75	7.00	10.00	
x_2		4.00	2.25	1.60	1.25	y_3				5.00	8.75	
x_3				1.00	2.25	y_4					5.00	
y_1		2.00	3.75	5.40	7.00	$S_M =$	35	D - F			175	
y_2			3.00	5.00	6.75	x_1	35.00	40.00	45.00	50.00	55.00	
						x_2		28.00	31.11	34.29	37.50	
$S_M =$	15	P - D			60	75	x_3			21.00	22.40	24.00
x_1	15.00	18.00	21.00	24.00	27.00	x_4				14.00	14.00	
x_2		10.00	11.25	12.60	14.00	x_5					7.00	
x_3			5.00	5.00	5.25	y_1		2.00	3.89	5.71	7.50	
y_1		2.00	3.75	5.40	7.00	y_2			3.89	7.31	10.50	
y_2			3.75	6.40	8.75	y_3				5.60	10.00	
y_3				5.60	6.75	y_4					7.00	
z_1			.25	.60	1.00	z_1			.11	.29	.50	
z_2				1.00	2.25	z_2				.40	1.00	
z_3					3.00	z_3					1.00	