

Weiss theory of ferromagnetism , Lec - 3

In order to establish a relation between the curie temperature T_f , and the molecular field constant γ , We assume that $\chi \ll 1$ (near the origin) , the Brillouin function is approximately given by

$$B_J(\chi) = (J+1) \chi / 3J \quad (9)$$

Using (9) in (6) , we get

$$M = N g J \mu_B (J+1) \chi / 3 \quad (10)$$

The slope of this is

$$Ng\mu_B (J+1) / 3 \quad (11)$$

This is the slope of the tangent of the curve at the origin .

Putting $T = T_f$ in (8) , we get

$$\text{Slope} = KT_f / gJ\mu_B\gamma \quad (12)$$

From (11) and (12) ,

$$KT_f / gJ\mu_B \gamma = Ng\mu_B (J+1) / 3$$

$$\therefore 3 KT_f / \gamma = Ng^2 \mu_B^2 J(J+1) \quad (13)$$

$$\therefore T_f = (N \mu^2 / 3K) \gamma \quad (14)$$

Where $\mu^2 = g^2 \mu_B^2 J(J+1)$

or , $\mu = g\mu_B \sqrt{J(J+1)}$

since $N\mu^2 / 3K$ is constant ,

$$T_f \propto \gamma$$

Thus T_f is proportional to γ .