$\vec{G} \cdot \vec{T} = 2\pi N$ prove

or

prove that Reciprocal lattice is a Bravis lattice.

Proof $\exp.\{i(\vec{G} \cdot \vec{T})\} = 1$

W.K.T

$$\vec{T} = n_1\vec{a} + n_2\vec{b} + n_3\vec{c}$$

$$\vec{G} = h\vec{A} + k\vec{B} + l\vec{C}$$

$$\therefore \vec{G} \cdot \vec{T} = (n_1 h + n_2 k + n_3 l)\, 2\pi$$

or $\vec{G} \cdot \vec{T} = 2\pi N$

where N is an integers

Multiplying in both sides of eqn.

$$i(\vec{G} \cdot \vec{T}) = i\, 2\pi N$$

$$\exp.\{i(\vec{G} \cdot \vec{T})\} = \exp\{i\, 2\pi N\}$$

$$\exp.\{i(\vec{G} \cdot \vec{T})\} = 1$$

· properties of reciprocal lattice :-

1. The reciprocal of reciprocal lattice is direct lattice.

2. Every reciprocal lattice vector is normal to lattice plane of the direct lattice.

3. The volume of unit cell of reciprocal lattice (V) is inversely proportional to the volume of unit cell of direct lattice (v).

$$V = \frac{(2\pi)^3}{v}$$

4. The lattice interval $d_{h,k,l}$ of lattice plane (h, k, l) of direct lattice is inversely - proportional to the reciprocal lattice vector. ($\vec{G}$)

$$\therefore \quad d_{h,k,l} = \frac{2\pi}{\vec{G}_{h,k,l}}$$

5. The Bragg's diffraction rule can be expressed in terms of reciprocal lattice vector $\vec{G}$ as

$$2\vec{k}\cdot\vec{G} + \vec{G}^2 = 0$$

where, $\vec{k}$ is the wave vector of incident wave

6. Reciprocal of a simple cubic lattice is also simple cubic.