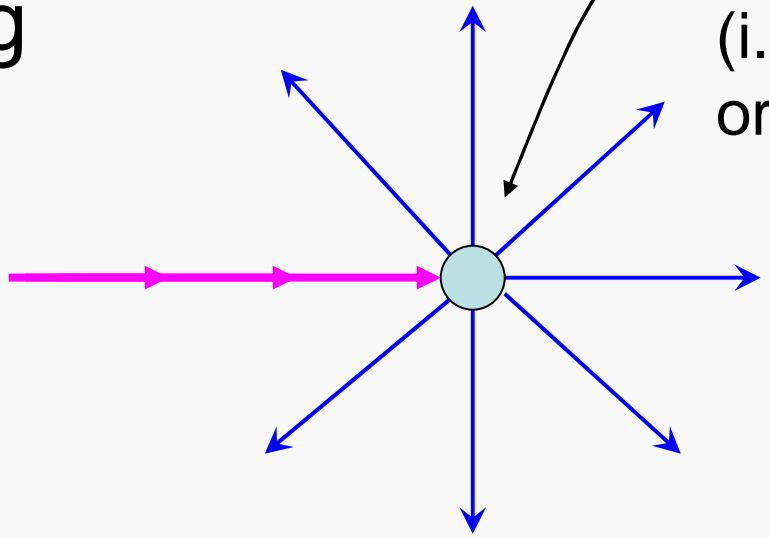
Scattering = EM interacts with matter and changes direction, usually without changing energy

This can be described using both the wave or particle nature of light:

1) Wave – EM induces oscillations in electrical charge of matter $\Rightarrow$ resulting in oscillating dipoles which in turn radiate secondary waves in all directions = scattered radiation
2) Particle (or Quantum) – EM interacts with matter to form a virtual state (lifetime 10^{-14} s) which reemits in all directions.

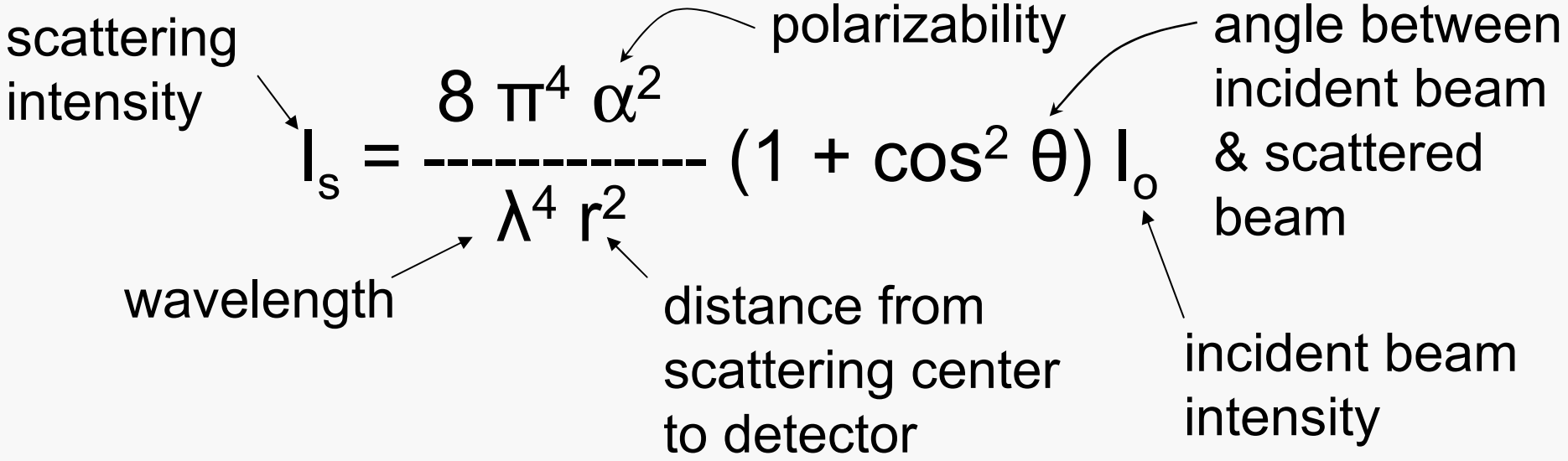
Raman effect = when some molecules return to a different state $\Rightarrow$ change in frequency

Scattering



Many types of scattering exist depending on several parameters characterizing the system, we will be concerned with:
Rayleigh Scattering, Large Particle Scattering and the Raman Effect (Raman Scattering or Raman Spectroscopy)

Rayleigh Scattering – scattering by particles whose longest dimension is < 5 % to 10 % of λ with no change in observed frequency



Notice the fourth power dependence on wavelength meaning short wavelengths are scattered more efficiently ⇒ sky is blue

Polarizability (α) is measure of how well a given frequency induces a dipole in a substance

α Tends to be large for large molecules (e.g., proteins)

Large Particle Scattering – particle dimensions < 10 % λ to 1.5 λ

Applies in techniques like turbidimetry and nephelometry

Large particles do not act as a point source & give rise to various interference phenomena

Forward scatter becomes greater than back scatter