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Velocity - Movement of Matter in Space and Time

Matter and Vacuum - Refraction, max. Phasevelocity

Lightspeed, Groupvelocity max.:

$$
\begin{aligned}
c = \frac{|\mathcal{E}|}{|\mathcal{B}|} = \frac{1}{\sqrt{\epsilon_0 \mu_0}} \left[\frac{F_{\mathcal{B}}}{F_{\mathcal{E}}} \right] = \frac{1}{\sqrt{\epsilon_0 \mu_0}} = \sqrt{v_{phase} \cdot v_{matter}} = \eta \sqrt{\varepsilon \mu} = \eta \sqrt{\varepsilon_0 \varepsilon_r \mu_0 \mu_r} = \frac{\omega}{k} = \frac{\lambda}{\mathcal{T}} = \nu \lambda = -\frac{d\lambda}{d\nu} \nu^2 \\
= \lambda^2 \frac{\mathcal{J}_\lambda}{\mathcal{J}_\nu} = \frac{\langle |\mathcal{S}| \rangle}{\langle \mathrm{w}_{EM} \rangle} = \eta \cdot c_{ph} = v_{gr}^{max} \\
\leq v_{ph} - \lambda \frac{d}{d\lambda} v_{ph} = \frac{d}{dk} \omega = v_{gr}
\end{aligned}
\tag{1}
$$

where:

$\eta \equiv$ Refraction Index (Vacuum vs. Matter)

$F_{\mathcal{E}} = q\mathcal{E} \equiv$ Coulomb-Force (Electric, charge presence)

$F_{\mathcal{B}} = q(v \times \mathcal{B}) \equiv$ Lorentz-Force (Magnetic, charge movement)

$\left[\frac{F_{\mathcal{B}}}{F_{\mathcal{E}}} \right] = 1$

$\mathcal{J} \equiv$ Flux Density

$\mathcal{S} \equiv$ Poynting-Vector, Intensity

$\mathrm{w}_{EM} \equiv$ Energy Density ElectroMagnetic