

Doppler Shift for E-M Waves

A Note on Approximations

$$f' = f \left(\frac{1 + \beta}{1 - \beta} \right)^{\frac{1}{2}} \quad \xrightarrow{\beta \ll 1} \quad f' \approx f(1 + \beta)$$

why?

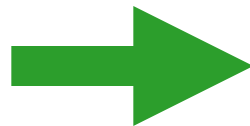
Taylor Series: Expand $F(\beta) = \left(\frac{1 + \beta}{1 - \beta} \right)^{\frac{1}{2}}$ around $\beta = 0$

$$F(\beta) = F(0) + \frac{F'(0)}{1!} \beta + \frac{F''(0)}{2!} \beta^2 + \dots$$

Evaluate:

$$F(0) = 1$$

$$F'(0) = 1$$



$$F(\beta) \approx 1 + \beta$$

NOTE:

$$F(\beta) = (1 + \beta)^{1/2}$$



$$F(\beta) \approx 1 + \frac{1}{2} \beta$$