Parameters: physical and computational

beta (of the ions)

$$\beta_i = \frac{n_i k_B T_i}{B^2/(8\pi)} = \frac{\text{thermal pressure}}{\text{magnetic pressure}}$$

sigma (of the ions)

$$\sigma_i = \frac{B^2/(4\pi)}{n_i m_i c^2} = \frac{\text{magnetic pressure}\,(\times 2)}{\text{rest-mass energy density}}$$

temperature ratio

$$\frac{T_e}{T_i} = \frac{\text{electron temperature}}{\text{ion temperature}}$$

Computational

d_{stripe}

dv_{stripe}

n_{stripe}

m_y

n_{times}

m_i/m_e

ppc

c/ω_{pe}

Full relativistic definition of sigma includes enthalpy

sigma, including enthalpy

$$\sigma_w = \underbrace{\frac{\frac{m_i}{m_e}+1}{\frac{m_i}{m_e}\left(1+\frac{\hat{\gamma}_i}{\hat{\gamma}_i-1}\frac{k_B T_i}{m_i c^2}\right)+\left(1+\frac{\hat{\gamma}_e}{\hat{\gamma}_e-1}\frac{k_B T_e}{m_e c^2}\right)}}_{\approx 1 \text{ for a cold plasma}} \; \frac{B^2}{\underbrace{4\pi(n_i m_i + n_e m_e)c^2}}$$

≈ 1 for a cold plasma

$$\approx \frac{B^2}{4\pi n_i m_i c^2} \equiv \sigma_i$$

For a high-beta (thermally ‘hot’) plasma, the contribution from the thermal pressure is non-negligible

One more important definition: Alfvén velocity, which describes the speed of magnetic waves

Alfvén velocity

$$\frac{v_A}{c} = \sqrt{\frac{\sigma_w}{1+\sigma_w}}$$