Summary of the MHD Equations

For most applications in this book the MHD equations are taken as inviscid and adiabatic. Situations where neglected terms are needed are discussed in later chapters. Thus, in summary, the simple form of the MHD equations are

$$\frac{\partial \rho}{\partial t} + \nabla \cdot (\rho \mathbf{v}) = 0. \tag{2.18}$$

$$\rho \frac{\partial \mathbf{v}}{\partial t} + \rho(\mathbf{v} \cdot \nabla)\mathbf{v} = -\nabla p + \mathbf{j} \times \mathbf{B} + \rho \mathbf{g}. \tag{2.19}$$

$$\frac{\partial p}{\partial t} + \mathbf{v} \cdot \nabla p = -\gamma p \nabla \cdot \mathbf{v}. \tag{2.20}$$

$$p = 2\rho \mathrm{R} T. \tag{2.21}$$

$$\mathbf{j} = \nabla \times \mathbf{B}/\mu. \tag{2.22}$$

$$\nabla \cdot \mathbf{B} = 0. \tag{2.23}$$

$$\frac{\partial \mathbf{B}}{\partial t} = -\nabla \times \mathbf{E}. \tag{2.24}$$

$$\frac{1}{\sigma}\mathbf{j} = \mathbf{E} + \mathbf{v} \times \mathbf{B}. \tag{2.25}$$

Prof. Alan Hood

2000-01-11