EQUATIONS

$$
\begin{aligned}
\partial_t \rho + \nabla \cdot (\rho \mathbf{u}) &= 0 \\
\partial_t (\rho \mathbf{u}) + \nabla \cdot (\rho \mathbf{u}\mathbf{u} - \alpha \mathbf{B}\mathbf{B}) &= -\nabla (p_t) - \sigma C_k T_a^{1/2} \left(\hat{\boldsymbol{\Omega}} \times \rho \mathbf{u} \right) + \mathbf{F} \\
&\quad + \sigma C_k \left[\nabla^2 \mathbf{u} + \frac{1}{3} \nabla (\nabla \cdot \mathbf{u}) \right] + \rho g \hat{z} \\
\partial_t T + \nabla \cdot (\mathbf{u} T) + (\gamma - 2) T \nabla \cdot \mathbf{u} &= \frac{\gamma C_k}{\overline{\rho}} \nabla \cdot (K_z \nabla T) \\
&\quad + \frac{\zeta C_k \alpha (\gamma - 1)}{\overline{\rho}} |\nabla \times \mathbf{B}|^2 + V_\mu \\
\partial_t \mathbf{B} &= \nabla \times (\mathbf{u} \times \mathbf{B}) + C_k \zeta \nabla^2 \mathbf{B} \\
\nabla \cdot \mathbf{B} &= 0 \\
p_t &= p_g + p_m = \rho T + \alpha \frac{|\mathbf{B}|^2}{2} \\
\alpha &= \sigma \zeta Q C_k^2 \\
V_\mu &= \frac{(\gamma - 1) C_k}{\rho} \sigma \partial_i u_j (\partial_i u_j + \partial_j u_i - \frac{2}{3} \nabla \cdot \mathbf{u} \delta_{ij})
\end{aligned}
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