

$$\mathbf{1} \quad \nabla \ln \gamma^2$$

Eq.(11) of BEO96:

$$\gamma^2 = \frac{1}{2} + \sqrt{\frac{1}{4} + \frac{9}{16} \frac{\mathbf{S}^2}{\rho^2}} \quad (1)$$

$$\nabla \gamma^2 = \frac{1}{2\sqrt{\frac{1}{4} + \frac{9}{16} \frac{\mathbf{S}^2}{\rho^2}}} \frac{9}{16} \left(\frac{\nabla \mathbf{S}^2}{\rho^2} - \frac{\mathbf{S}^2}{\rho^2} \nabla \ln \rho \right) \quad (2)$$

$$(\nabla \mathbf{S}^2)_i = 2S_j S_{j,i} \quad (3)$$