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1–3 :

$$(\nabla \times \mathbf{B}(\mathbf{x})) \times \mathbf{B}(\mathbf{x}) = \mu \nabla P(\mathbf{x}), \ \nabla \cdot \mathbf{B}(\mathbf{x}) = 0. \quad (1.1)$$

$\mathbf{B}(\mathbf{x})$ $P(\mathbf{x})$ B

$$\nabla \times \mathbf{B}(\mathbf{x}) = \alpha(\mathbf{x})\mathbf{B}(\mathbf{x}), \quad (1.2)$$

$\nabla \times \mathbf{B}(\mathbf{x}) = \mathbf{J}(\mathbf{x})$ $\alpha(\mathbf{x})$ $\mathbf{x}$. E (1.2) $\alpha(\mathbf{x})$ $\alpha(\mathbf{x})$ fi $\mathbf{B}(\mathbf{x})$. $\nabla\alpha(\mathbf{x})\cdot\mathbf{B}(\mathbf{x})=0$ E (1.2) $\alpha(\mathbf{x})$ fi $\mathbf{B}(\mathbf{x})$, C 1 3. $\alpha(\mathbf{x})$ $\psi(\mathbf{x})$ ($\psi(\mathbf{x})$). A $\alpha(\mathbf{x})$ $\mathbf{B}(\mathbf{x})$

$$\nabla \cdot [\nabla\alpha(\mathbf{x}) \times \mathbf{B}(\mathbf{x})] = 0. \quad (1.3)$$

E (1.3) fi $\nabla\alpha(\mathbf{x}) \times \mathbf{B}(\mathbf{x})$ ($\alpha(\mathbf{x}) = C$). E (1.3) E (1.2), $\nabla\cdot\mathbf{B}(\mathbf{x}) = 0$

$$\nabla \cdot (\mathbf{X} \times \mathbf{Y}) = (\nabla \times \mathbf{X}) \cdot \mathbf{Y} - \mathbf{X} \cdot (\nabla \times \mathbf{Y}),$$

$\mathbf{X}$ $\mathbf{Y}$ fi. E (1.2) $\alpha(\mathbf{x})=\alpha$, fi

$$\mathbf{J}(\mathbf{x}) = \frac{\pm\alpha^2\overline{\psi}(\mathbf{x})}{\sqrt{\beta + \alpha^2\overline{\psi}^2(\mathbf{x})}}\mathbf{B}(\mathbf{x}), \qquad (1.5)$$

α $\beta>0$. E (1.5)

J(**x**

E (2.9) P ($\overline{\psi}$) = B

$$\nabla \times \mathbf{B}_{\beta}(\mathbf{x}) = \alpha_{\beta}(\mathbf{x})\mathbf{B}_{\beta}(\mathbf{x}), \tag{2.10}$$

$$\begin{aligned} \alpha_{\beta}(\mathbf{x}) &= \frac{\mathrm{G}_{\beta}\left(\overline{\psi}\right)}{\overline{\psi}} = \pm\frac{\mathrm{G}\left(\overline{\psi}\right)}{\sqrt{\beta + \mathrm{G}^{2}\left(\overline{\psi}\right)}}\,\frac{\mathrm{G}\left(\overline{\psi}\right)}{\overline{\psi}} \\ &= \pm\frac{\mathrm{G}\left(\overline{\psi}\right)}{\sqrt{\beta + \mathrm{G}^{2}\left(\overline{\psi}\right)}}\,\alpha(\mathbf{x}). \end{aligned} \tag{2.11}$$

T_{β} (E (27)) B E (2.6) $\mathbf{B}_{\beta}$ (r, z) (E 2.8) B E - (2.10) α

α_ζ (r,z) (E 3.5) fi -

$-|\alpha|<\alpha_\zeta(r,z)<|\alpha|$ $\alpha_\zeta(r,z)=0$ (r,z)

$\overline{\psi}(r,z) = 0$.

$\overline{\psi}(r,z)$

$$(\alpha R) = \frac{3\alpha R}{3-(\alpha R)^2}\,. \qquad (3.16)$$

$\mathbf{J}_{\zeta,3}(r, z)$ (E 3.15) = 0 fi S_m^2. E (3.15) - $\mathbf{J}_{\zeta,3}(r, z)$ $\mathbb{R}^3$ z (r = 0). E (3.16)

$$|\alpha|R_1 \approx 5.7635, \quad |\alpha|R_2 \approx 9.0950, \quad |\alpha|R_3 \approx 12.3229, \quad |\alpha|R_4 \approx 15.5146\,.$$

A $m\to\infty$ R_m $|\alpha|R_k \approx (m+1)\pi$. . A ψ_4 (r, z) (E 3.12). $\mathbf{J}_{\zeta,4}(r, z) = \nabla\times\mathbf{B}_{\zeta,4}(r, z)$ $\psi_4(r, z) = 0$ E (3.12) (3.14) fi

$$G_3(\alpha R) + \alpha^2 z^2 G_4(\alpha R) = 0\,. \qquad (3.17)$$

E (3.17) z = 0 fi $\mathbb{S}_m^1 : z = 0,$

. C

$$\mathbf{B}(x, y) = -\psi_y \hat{e}_x + \psi_x \hat{e}_y + \sqrt{2} m e^{\psi/2} \hat{e}_z \,, \tag{4.7}$$

$G(\psi) = \sqrt{2} m e^{\psi/2}$. A

T_β (E 2.7) fi

$$\mathbf{B}_\beta(x, y) = -\psi_y \hat{e}_x + \psi_x \hat{e}_y \pm \sqrt{\beta + 2m^2 e^\psi}\, \hat{e}_z \tag{4.8}$$

$G_\beta(\psi) = \pm\sqrt{\beta + 2m^2 e^\psi}$. B E (4.6)

$P(\psi) =$ fi (E 4.8)

$$\nabla \times \mathbf{B}_\beta = \mp \frac{m^2 e^\psi}{\sqrt{\beta + 2m^2 e^\psi}} \mathbf{B}_\beta \,. \tag{4.9}$$

F E (4.7) (4.8)

E (4.4) $P(\psi) =$

$$\nabla^2 \psi = -m^2 e^\psi \,. \tag{4.10}$$

. E E (4.10)

fi 22 . ,

. x + iy

$f(x + iy) = u(x, y) + iv(x, y$

α $\zeta > 0$ j .W

(E 5.5) E (5.2)
$G(\psi_\lambda) = A$ $\alpha(\psi_\lambda+\gamma)$

$$\nabla \times \mathbf{B} = -\alpha A \quad \alpha(\psi_\lambda + \gamma) \mathbf{B}$$
$$= - \frac{\alpha A}{\left[\alpha A(\lambda x + \sqrt{1-\lambda^2} y + c)\right]} \mathbf{B}. \quad (5.6)$$

E (5.6) $\mathbf{J} = \nabla \times \mathbf{B}$
fi $-\alpha A \mathbf{B}$
.
A T_β (E 2.7) $\beta > 0$:
$G(\psi_\lambda) \to G_\beta(\psi_\lambda) = \pm\sqrt{\beta + G^2(\psi_\lambda)}$ fi
(E 4.1):

$$\mathbf{B}_\beta(x, y) = -(\psi_\lambda)_y \hat{} \quad)$$