Table 1a: Metrics for the Coulomb and Ampère Maxwell Laws

Metric	Metrical Structure
Minkowski	$ds^2 = -c^2 dt^2 + dX^2 + dY^2 + dZ^2$, $g_{00} = -1,\ g_{11} = 1,\ g_{22} = 1,\ g_{33} = 1$
Schwarzschild	$ds^2 = -\left(1 - \frac{2GM}{rc^2}\right)c^2 dt^2 + \left(1 - \frac{2GM}{rc^2}\right)^{-1} dr^2 + r^2 d\theta^2 + r^2 \sin^2\theta \, d\phi^2$, $g_{00} = -\left(1 - \frac{2GM}{rc^2}\right),\ g_{11} = \left(1 - \frac{2GM}{rc^2}\right)^{-1},\ g_{22} = r^2,\ g_{33} = r^2 \sin^2\theta$
Gödel	$ds^2 = \frac{1}{2\omega^2}\left(-(dt\,c + \exp(x)\,dz)^2 + dx^2 + dy^2 + \frac{1}{2}\exp(2x)\,dz^2\right)$ Diagonals and off-diagonals
FLRW	$ds^2 = -c^2 dt^2 + a(t)\left(\frac{dr}{1-kr^2} + r^2 d\theta^2 + r^2 \sin^2\theta \, d\phi^2\right)$ $g_{00} = -1,\ g_{11} = \frac{a^2(t)}{1-kr^2},\ g_{22} = a^2 r^2,\ g_{33} = a^2 r^2 \sin^2\theta$ with: $\frac{\ddot{a}}{a} = -\frac{4\pi}{3} G(\rho + 3p)$, $\left(\frac{\dot{a}}{a}\right)^2 = \frac{8\pi}{3} G\rho - \frac{k}{a^2}$
General Spherical	$ds^2 = -e^{2\alpha(r,t)} c^2 dt^2 + e^{2\beta(r,t)} dr^2 + r^2 d\theta^2 + r^2 \sin^2\theta \, d\phi^2$ $g_{00} = -e^{2\alpha},\ g_{11} = e^{2\beta},\ g_{22} = r^2,\ g_{33} = r^2 \sin^2\theta$

Table 1a Continued

Metric	Metrical Structure
Crotters General	$ds^2 = -A\left(c(r)\right)^{1/2} dt^2 c^2 + B\left(c(r)\right)^{1/2} r^2 + c(r)\left(d\theta^2 + \sin^2\theta\, d\phi^2\right)$, where $c(r) = \left(\lvert r - r_0 \rvert^n + \alpha^n\right)^{2/n}$
Crotters / Original Schwarzschild	$n = 3, \quad r_0 = 0, \quad r > r_0$
Crotters / Schwarzschild	$n = 1, \quad r_0 = \alpha, \quad r > r_0$
Crotters Type One	$ds^2 = -c^2 dt^2 + dr^2, \lvert r - r_0 \rvert^2 \left(d\theta^2 + \sin^2\theta\, d\phi^2\right)$
Static de Sitter	$ds^2 = -\left(1 - \frac{r^2}{\alpha^2}\right) c^2 dt^2 + \left(1 - \frac{r^2}{\alpha^2}\right)^{-1} dr^2 + r^2 d\Omega^2$ $g_{00} = -\left(1 - \frac{r^2}{\alpha^2}\right), g_{11} = \left(1 - \frac{r^2}{\alpha^2}\right)^{-1}, g_{22} = r^2,$ $g_{33} = r^2 \sin^2\theta.$
Kasner	$ds^2 = -c^2 dt^2 + \sum_{j=1}^{D-1} t^{2p_j} (dx_j)^2,$ $\sum_{j=1}^{D-1} p_j = 1, \quad \sum_{j=1}^{D-1} p_j^2 = 1, \quad D > 3$
Perfect Fluid Sphere	$ds^2 = -(1 + ar^2) c^2 dt^2 + \frac{(1 - 3ar^2)^{2/3}}{(1 + 3ar^2)^{2/3} - br^2} \cdot dr^2 + r^2 d\theta^2 + r^2 \sin^2\theta\, d\phi^2$
Friedmann Dust	$ds^2 = -c^2 dt^2 + \left(\cosh\left(\frac{3t}{a} - 1\right)\right)^{2/3} \left(x^2 + y^2 + z^2\right)$

Table 1b: Charge and Current Densities for the Metrics of Table 1a.

Metric	Charge and Current Densities
Minkowski	$J^0 = 0, \quad J_r = 0, \quad J_\theta = 0, \quad J_\phi = 0$
Schwarzschild	$J^0 = 0, \quad J_r = 0, \quad J_\theta = 0, \quad J_\phi = 0$
Crothers / Schwarzschild	$J^0 = 0, \quad J_r = 0, \quad J_\theta = 0, \quad J_\phi = 0$
Gödel	$J^0 = -\phi \left(\frac{64\omega^8}{1024\omega^8 - 64\omega^4 + 1} \right),$ $J_r = -\frac{A^{(0)}}{\mu_0} \left(\frac{64\omega^8 - 4\omega^4}{32\omega^4 - 1} \right),$ $J_\theta = 0,$ $J_\phi = -\frac{A^{(0)}}{\mu_0} \left(\frac{(128\omega^8 - 8\omega^4) e^{-2x}}{1024\omega^8 - 64\omega^4 + 1} \right).$
FLRW	$J^0 = -3\phi\, \ddot{a}/a = 4\pi\phi\sigma(\rho + 3p),$ $J_r = -\frac{A^{(0)}}{\mu_0} \left(\frac{2}{a^4}(k + \ddot{a}^2)(kr^2 - 1) + \frac{\ddot{a}}{a^3}(kr^2 - 1) \right),$ $J_\theta = J_\phi \sin^2\theta = \frac{A^{(0)}}{\mu_0} \left(\frac{2}{a^4 r^2}(k + \ddot{a}^2) + \frac{\ddot{a}}{a^3 r^2} \right).$
Crothers General	$J^0 = -\ddot{C}\phi / (4ABC^2),$ $J_r = -\frac{A^{(0)}}{\mu_0} \left(\frac{5C\ddot{C} - 4\dot{C}^2}{4B^2C^3} \right),$ $J_\theta = \frac{A^{(0)}}{\mu_0} \left(\frac{2BC^{1/2} - \ddot{C}}{2BC^{5/2}} \right)$ $= J_\phi \sin^2\theta,$ where $\ddot{C} = \frac{d^2C}{dr^2}, \quad \dot{C} = \frac{dC}{dr}$

Table 1b Continued.

Carter with Defined $c(r)$	Here $c(r) = (\lvert r - r_0 \rvert^n + \alpha^n)^{2/n}$. In the Finite charge and current densities. In the special case: $r_0 = 0, \quad \alpha = 0$ the following are obtained. $J^0 = -\dfrac{\phi}{2r^4 AB}$, $J_r = \dfrac{A^{(0)}}{\mu_0} \cdot \dfrac{3}{2r^4 B^2}$, $J_\theta = \sin^2\theta . J_\phi = \dfrac{A^{(0)}}{\mu_0} \left(\dfrac{r^2 B - \lvert r \rvert}{r^6 B} \right)$
Static de Sitter	$J^0 = -\dfrac{3\phi}{r^2 - \alpha^2}$, $J_r = -\dfrac{A^{(0)}}{\mu_0} \left(\dfrac{3r^2 - 3\alpha^2}{\alpha^4} \right)$, $J_\theta = \sin^2\theta . J_\phi = \dfrac{A^{(0)}}{\mu_0} \cdot \dfrac{3}{\alpha^2 r^2}$
Wormhole Metric	$ds^2 = -c^2 dt^2 + dr^2 + (\ell^2 + k^2)(d\theta^2 + \sin^2\theta \, d\phi^2)$. Here: $J^0 = 0$, $J_r = -\dfrac{A^{(0)}}{\mu_0} \left(\dfrac{2k^2}{(\ell^2 + k^2)^2} \right)$, $J_\theta = J_\phi = 0$.
Alcubierre, Kerr and Charged Kerr	Here $R \wedge q \neq 0$ (?) so these metrics do not correctly obey the Ricci cyclic equation, usually known as the first Bianchi identity.

Table 1b Continued

General Spherical Metric

$$ds^2 = -c^2 dt^2 e^{2\alpha} + e^{2\beta} dr^2 + d\theta^2 + \sin^2\theta \, d\phi^2,$$

Here:

$$J^0 = \phi\left(e^{-2\beta-4\alpha}\left(\left(\left(e^{2\beta}\frac{d^2\beta}{dt^2}\right) + e^{2\beta}\left(\frac{d\beta}{dt}\right)^2 - \frac{d\alpha}{dt}e^{2\beta}\frac{d\beta}{dt} + e^{2\alpha}\frac{d\alpha}{dr}\frac{d\beta}{dr} - e^{2\alpha}\frac{d^2\alpha}{dr^2}\right) r - 2e^{2\alpha}\frac{d\alpha}{dr}\right)\right) \Big/ r,$$

$$J_r = \frac{A^{(0)}}{\mu_0}\left(e^{-4\beta-2\alpha}\left(\left(e^{2\beta}\frac{d^2\beta}{dt^2} + e^{2\beta}\left(\frac{d\beta}{dt}\right)^2 - \frac{d\alpha}{dt}e^{2\beta}\frac{d\beta}{dt} + e^{2\alpha}\frac{d\alpha}{dr}\frac{d\beta}{dr} - e^{2\alpha}\frac{d^2\alpha}{dr^2} - e^{2\alpha}\left(\frac{d\alpha}{dr}\right)^2\right) r + 2e^{2\alpha}\frac{d\beta}{dr}\right)\right) \Big/ r,$$

$$J_\theta = J_\phi \sin^2\theta = \frac{A^{(0)}}{\mu_0}\frac{1}{r^4}e^{-2\beta}\left(\left(\frac{d\beta}{dr} - \frac{d\alpha}{dr}\right) r + e^{2\beta} - 1\right).$$

The charge and current densities are <u>non - zero</u> in general.

Table 1b Continued

Metric	Charge and Current Densities
Friedman Dust	$J^{0} = -\frac{\phi}{a^{2}}\left(6\tanh\left(\frac{3t-a}{a}\right)^{2} - 9\right)$, $J_{r} = \frac{A^{(0)}}{\mu_{0}} \cdot \frac{3}{a^{2}\cosh\left(\frac{3t-a}{a}\right)^{2/3}}$, $= J_{\theta} = J_{\phi}$
Perfect Spherical Fluid	$J^{0} = -\phi\Big(\big((1-3ar^{2})^{1/3}(3ar^{2}+1)^{1/3}(7a^{3}br^{6}+7a^{2}br^{4}-4abr^{2}) + (1-3ar^{2})^{1/3}(-18a^{4}r^{6}-23a^{3}r^{4}+6a^{2}r^{2}+3a)\big) / \big((3ar^{2}+1)^{1/3}(9a^{5}r^{10}+21a^{4}r^{8}+10a^{3}r^{6}-6a^{2}r^{4}-3ar^{2}+1)\big)\Big)$, $J_{r} = \frac{A^{(0)}}{\mu_{0}}\Big((3ar^{2}+1)^{2/3}(3a^{3}b^{2}r^{8}+5a^{2}b^{2}r^{6}-4ab^{2}r^{4}-2b^{2}r^{2}) + (3ar^{2}+1)^{1/3}(-9a^{4}br^{8}-15a^{3}br^{6}+27a^{2}br^{4}+19abr^{2}+2b) - 9a^{4}r^{6}-63a^{3}r^{4}-47a^{2}r^{2}-9a\Big) / \big((1-3ar^{2})^{1/3}(3ar^{2}+1)^{2/3}(9a^{4}r^{8}+12a^{3}r^{6}-2a^{2}r^{4}-4ar^{2}+1)\big)$, $J_{\theta} = \cos^{2}\theta \cdot J_{\phi} = \frac{A^{(0)}}{\mu_{0}}\Big((3ar^{2}+1)^{1/3}(7a^{2}br^{6} + (1-3ar^{2})^{2/3}(3a^{2}r^{4}+2ar^{2}-1) + abr^{4}-2br^{2}) - 18a^{3}r^{6}-5a^{2}r^{4}+6ar^{2}+1\Big) / \big((1-3ar^{2})^{2/3}(3ar^{2}+1)^{1/3}(3a^{2}r^{8}+2ar^{6}-r^{4})\big)$

Table 1b Continued

Metric	Charge and Current Densities
Kasner	$J^0 = \frac{\phi}{t^2}\left(p_3^2 - p_3 + p_2^2 - p_2 + p_1^2 - p_1\right)$, $J_r = \frac{A^{(0)}}{\mu_0}\left(p_1 p_3 + p_1 p_2 + p_1^2 - p_1\right) t^{-2p_1-2}$, $J_\theta = \frac{A^{(0)}}{\mu_0}\left(p_2 p_3 + p_2^2 + (p_1 - 1) p_2\right) t^{-2p_2-2}$, $J_\phi = \frac{A^{(0)}}{\mu_0}\left(p_3^2 + (p_2 + p_1 - 1) p_3\right) t^{-2p_3-2}$.
Reisner - Nordström	$J^0 = -\phi Q^2 / (r^2 Q^2 - 2r^3 m + r^4)$, $J_r = -\frac{A^{(0)}}{\mu_0} \cdot \frac{1}{r^6}\left(Q^4 + (r^2 - 2rm) Q^2\right)$, $J_\theta = \frac{A^{(0)}}{\mu_0} \frac{Q^2}{r^6}$, $\quad J_\phi = J_\theta / \sin^2\theta$.
Simple Kerr	Not a solution of the Einstein Hilbert field equation, finite charge and current densities.

Crothers 1a

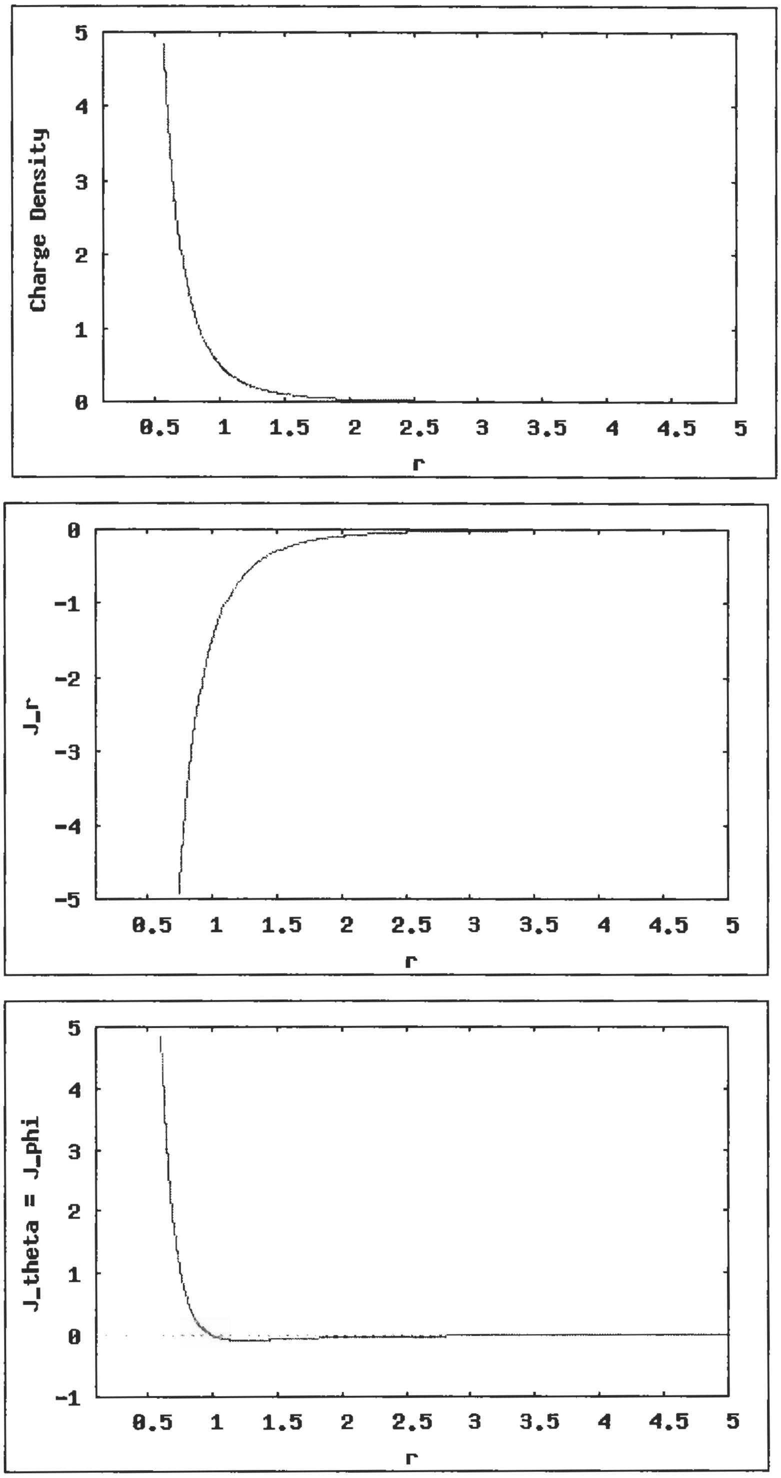


Fig. 1

Crothers 1a

r0=0, alpha=0, n=1, A=B=1

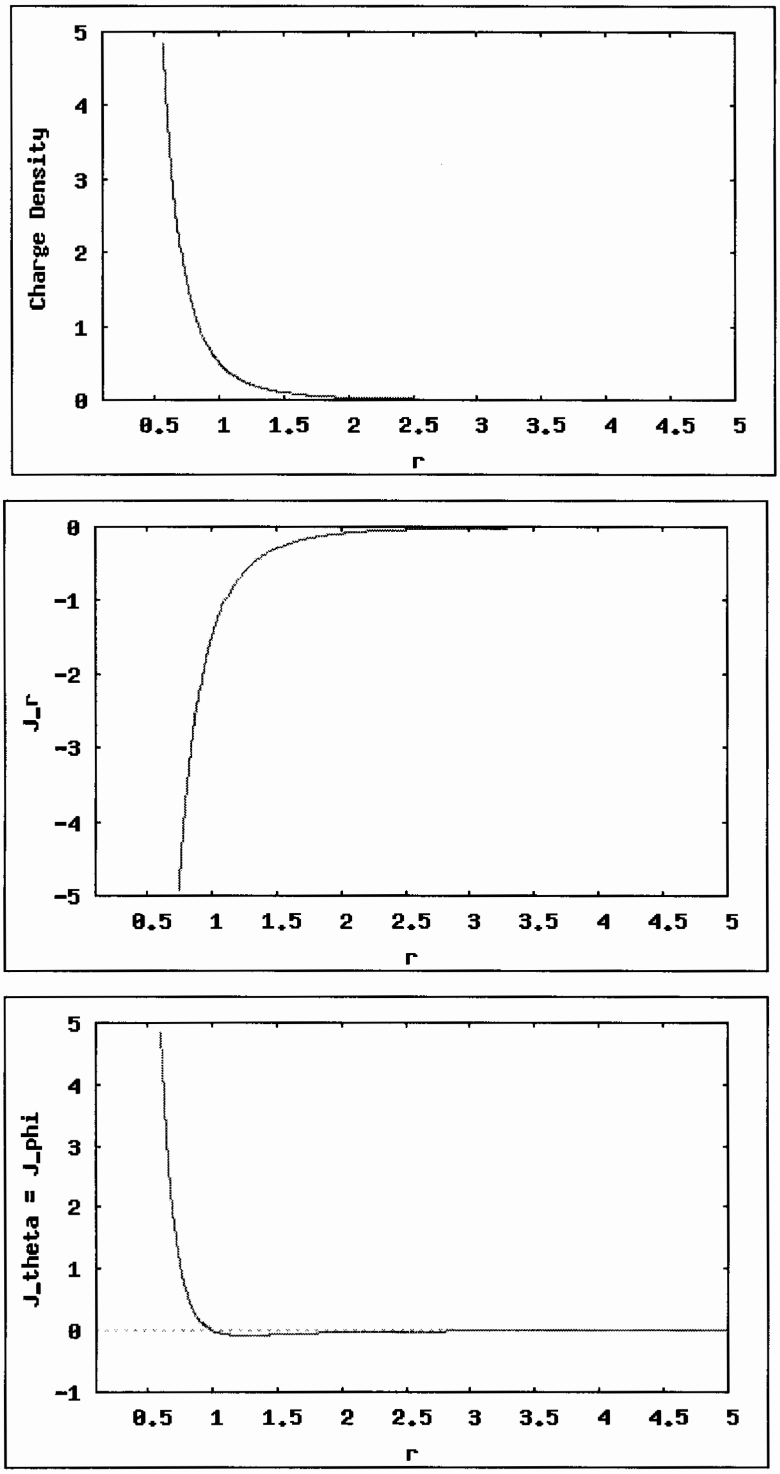
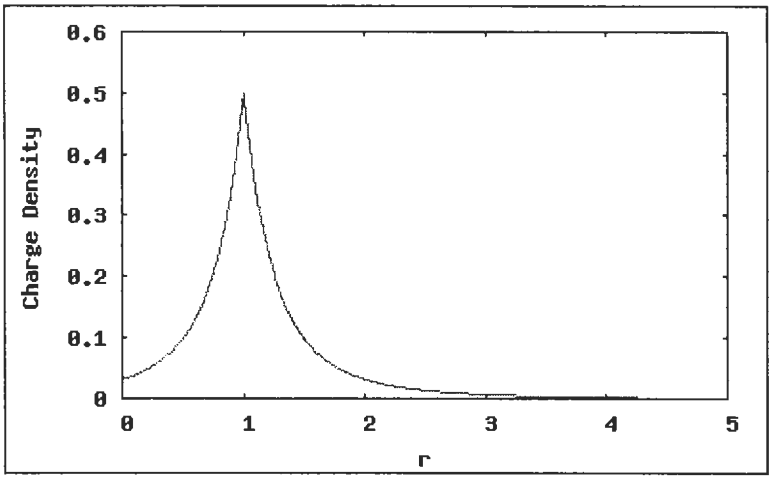
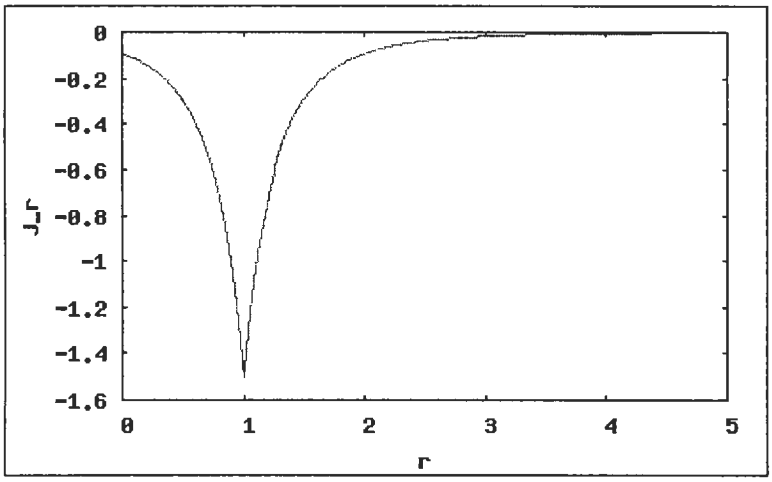


Fig 1a

Crothers 1a

r0=1, alpha=1, n=1, A=B=1 (Crothers / Schwarschild)





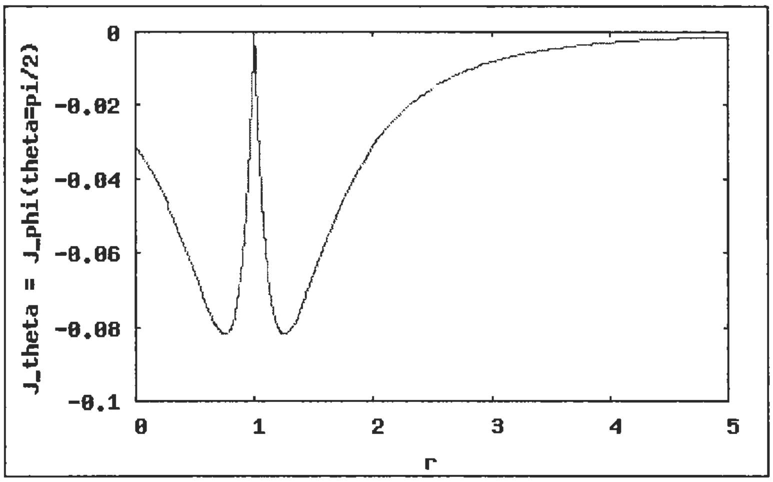
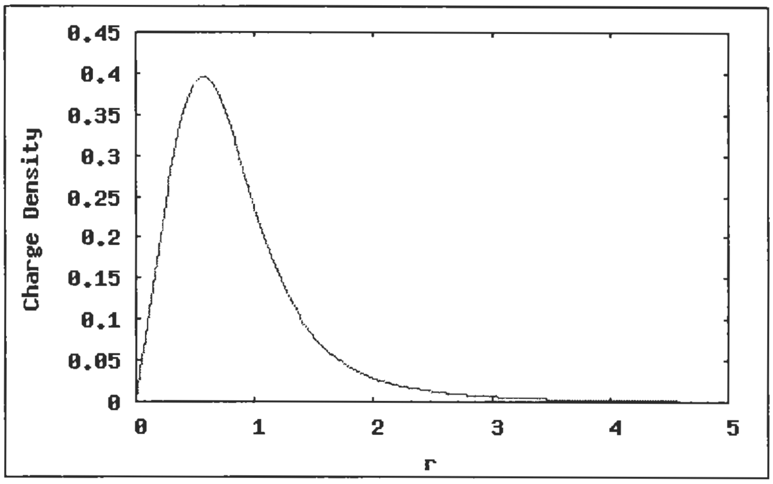


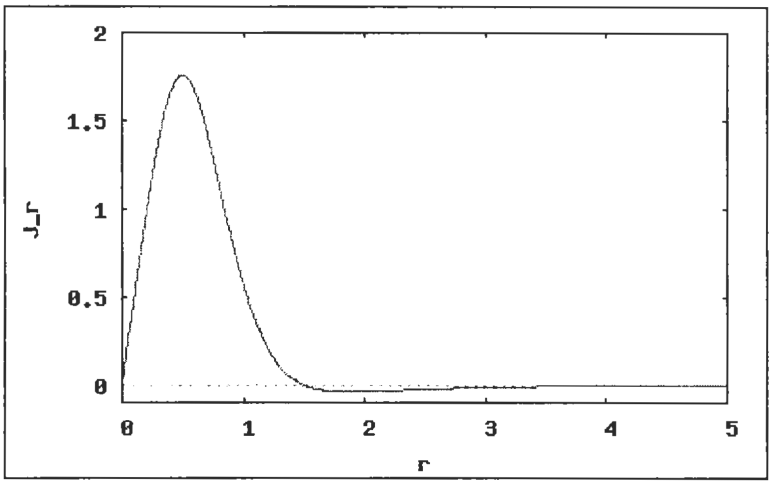
Fig 1b

12. Sep. 2007

Crothers 1a

r0=0, alpha=1, n=3, A=B=1 (Original Schwarschild)





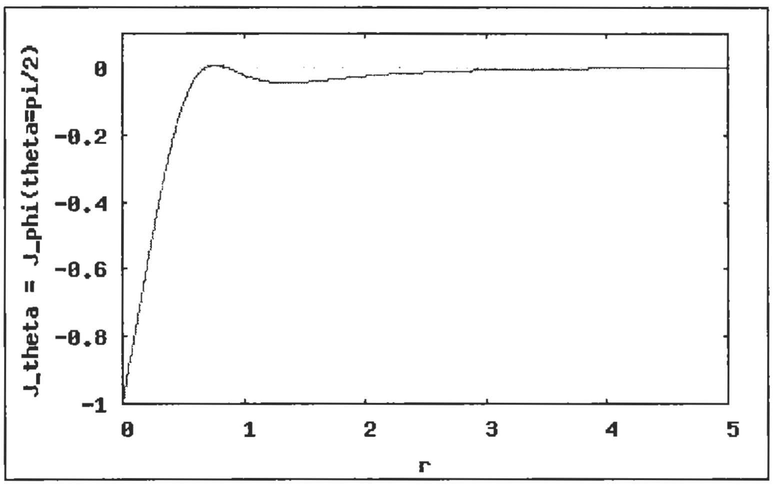
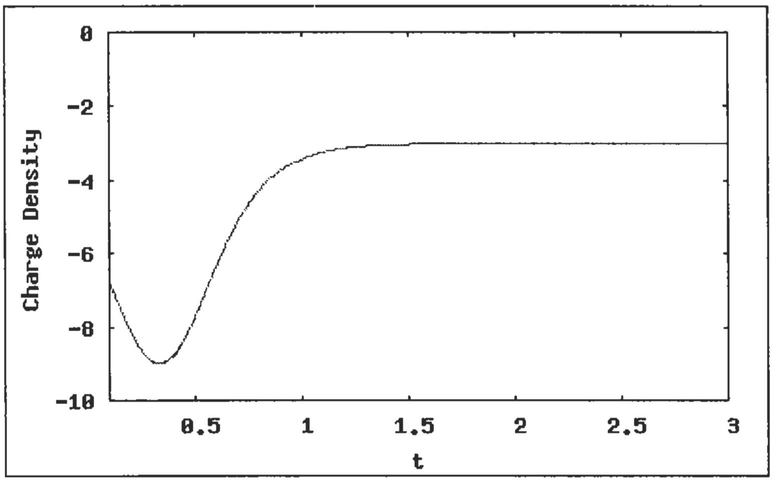


Fig 1c

Friedmann-Dust



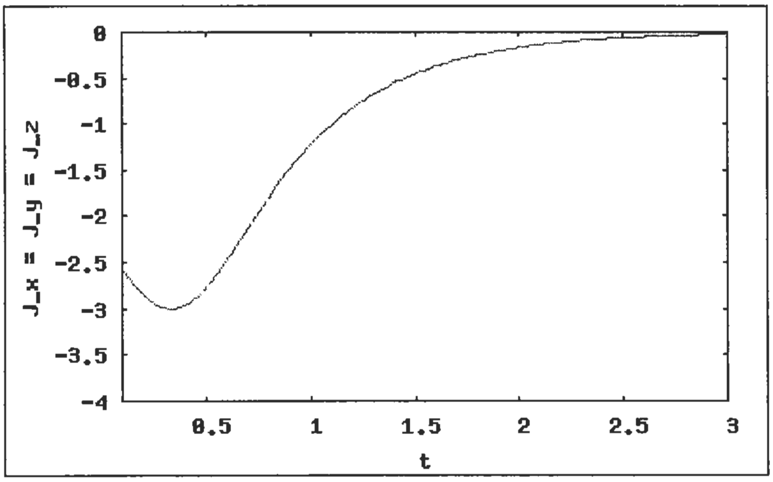
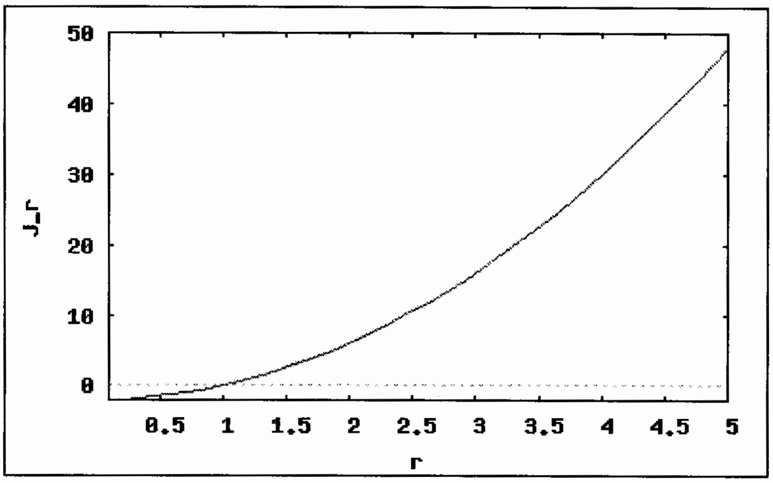


Fig. 2

Robertson-Walker with a=1=const

rho = 0



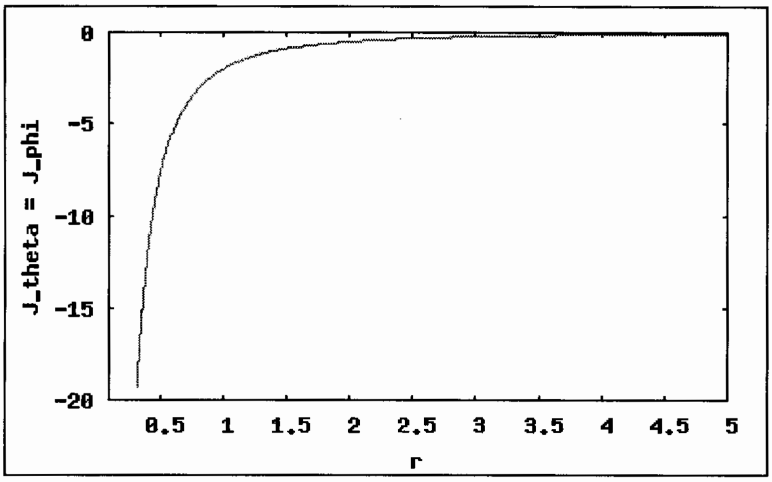


Fig. 3

Perfect Fluid, a=1, b=1

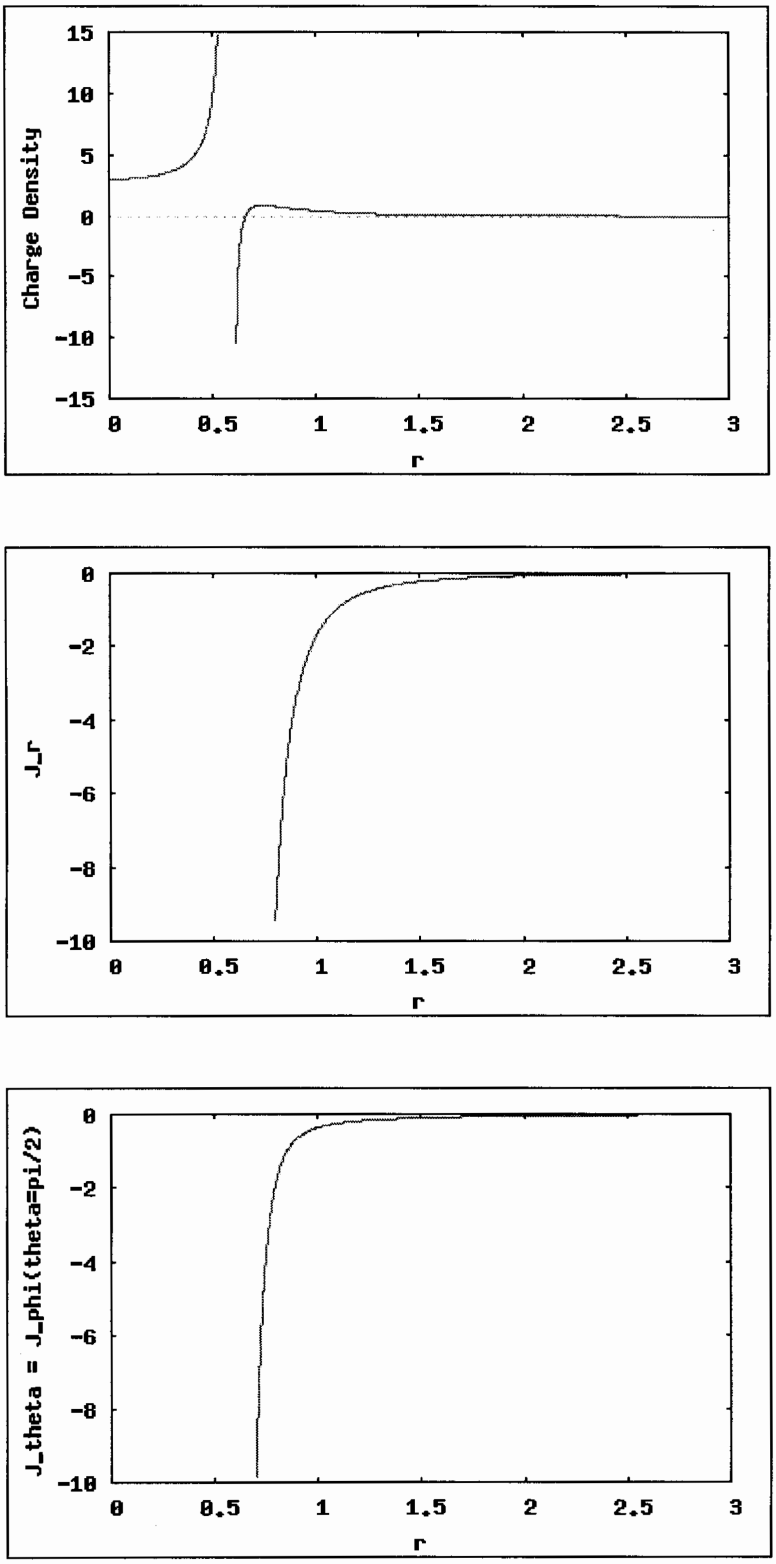


Fig. 4

Static de-Sitter

alpha=1

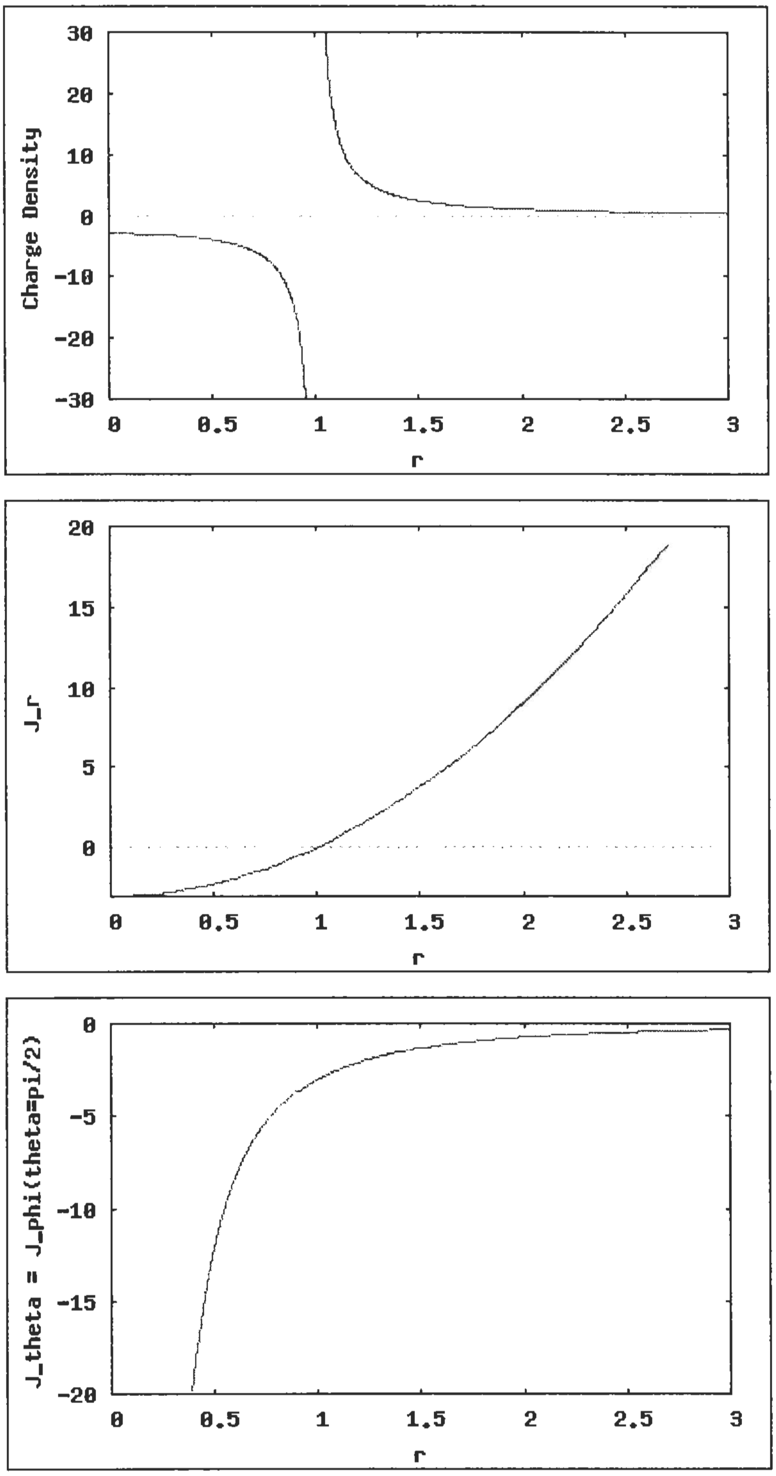


Fig 5

Reissner-Nordstrom

Q=1, M=2

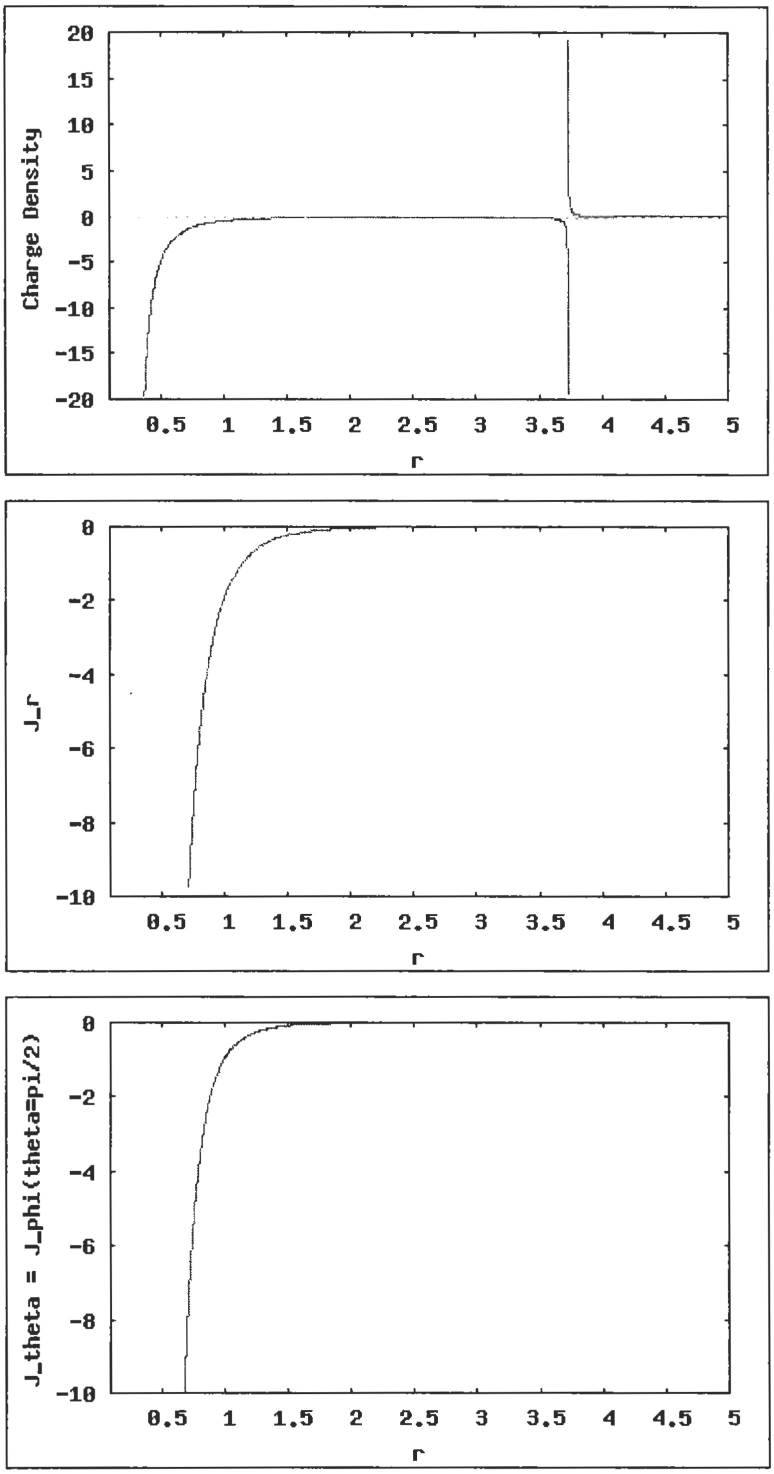


Fig. 6

12. Sep. 2007

Reissner-Nordstrom

Q=2, M=1

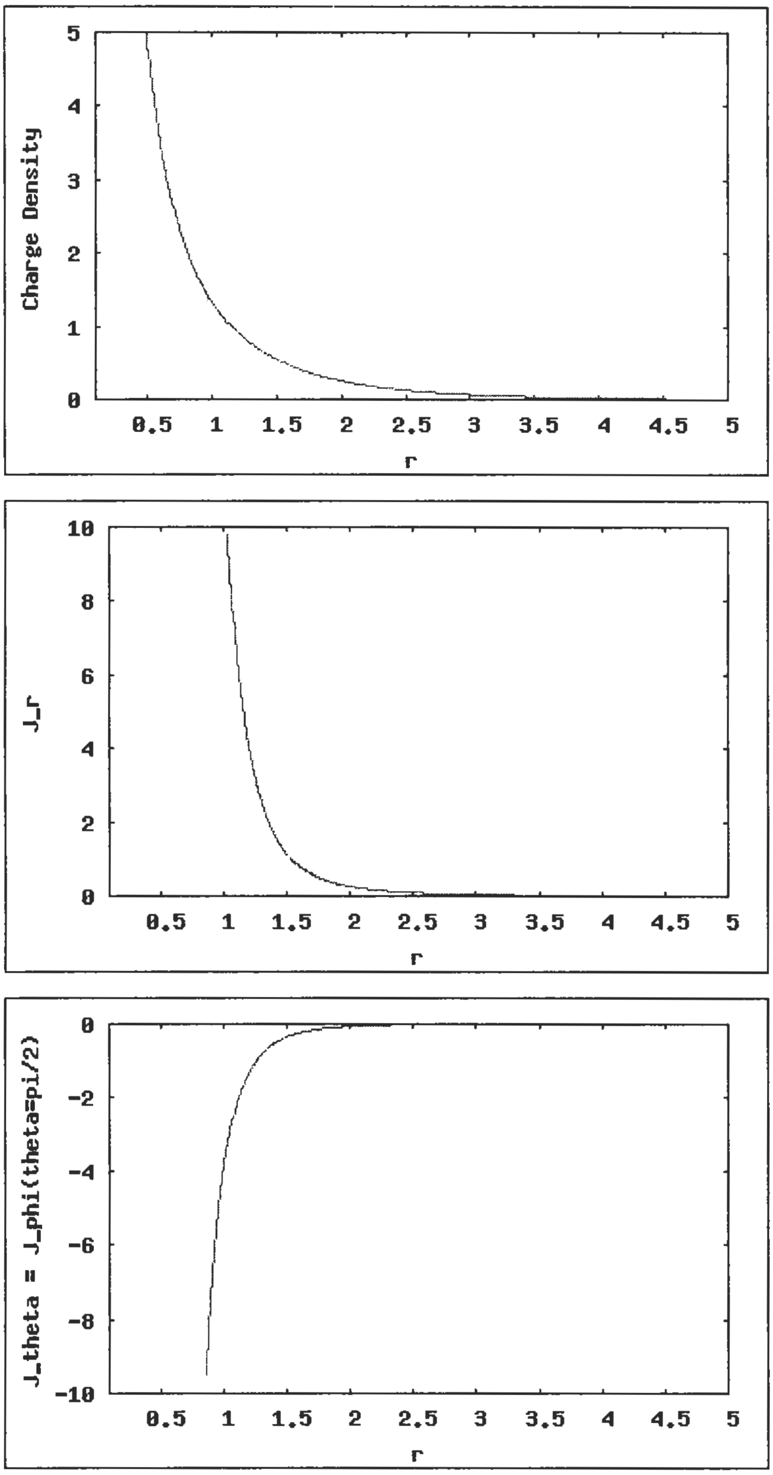


Fig 6a