

Prof. Remo Ruffini Festschrift. A conference in celebration of Prof. Remo Ruffini 80° birthday

16-18 May 2022

Europe/Paris timezone

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Prof. Remo Ruffini Festschrift. A conference in celebration of Prof. Remo Ruffini 80° birthday



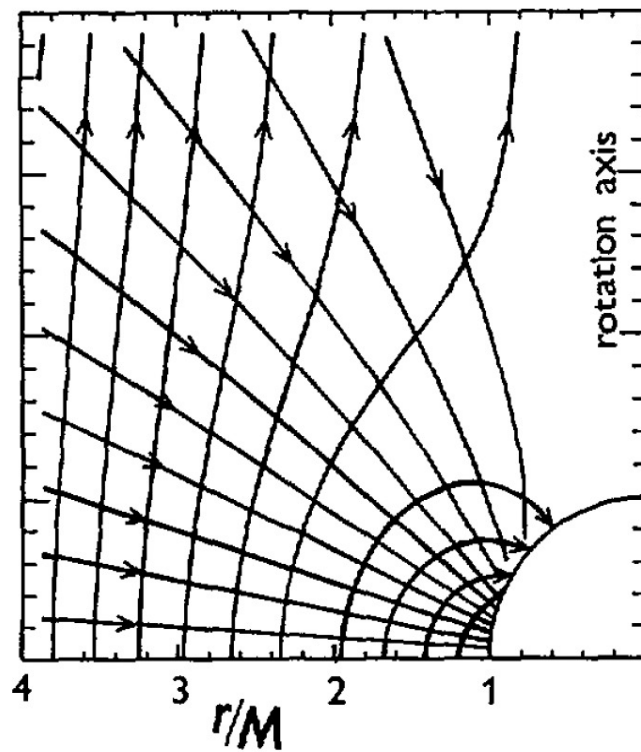
Director of ICRANet and President of ICRA, coauthor of more than 650 scientific publications and 13 books, Remo Ruffini received his doctorate at Sapienza (1967). He taught in Hamburg, Princeton University and the Institute for Advanced Study, in Japan, in China (at USTC), in Australia and CBPF (Brazil). Some of his major results: boson stars, "Introducing the Black Hole" with J.A. Wheeler, the limiting critical mass of NS. He identified the first BH in our Galaxy (Cyg X-1) using UHURU satellite data with Riccardo Giacconi and received the Cressy Morrison Award (1973). Returning to Sapienza (1978), he promoted Rome-Stanford collaboration on gravitational wave detectors. With European, US and Chinese institutions he established ICRA and later ICRANet in Italy, Armenia, France and Brazil (2005). He developed the understanding of GRBs, confirmed by the largest telescopes on Earth and from space: from their discovery (1973) to their cosmological origin (1997) to the determination of seven different GRBs families and their conceptual understanding (2018). He has given evidence for 7 episodes characterizing the most general GRB and identified, in the Christodoulou - Ruffini - Hawking Mass formula, the energy source of the most energetic GRBs, the BDHN I, based on the Wald - Papapetrou solution (2022). He is currently also active with his collaborators in identifying the nature of our galactic core in terms of Dark matter.

Magnetized Kerr-Newman (MKN) black hole:

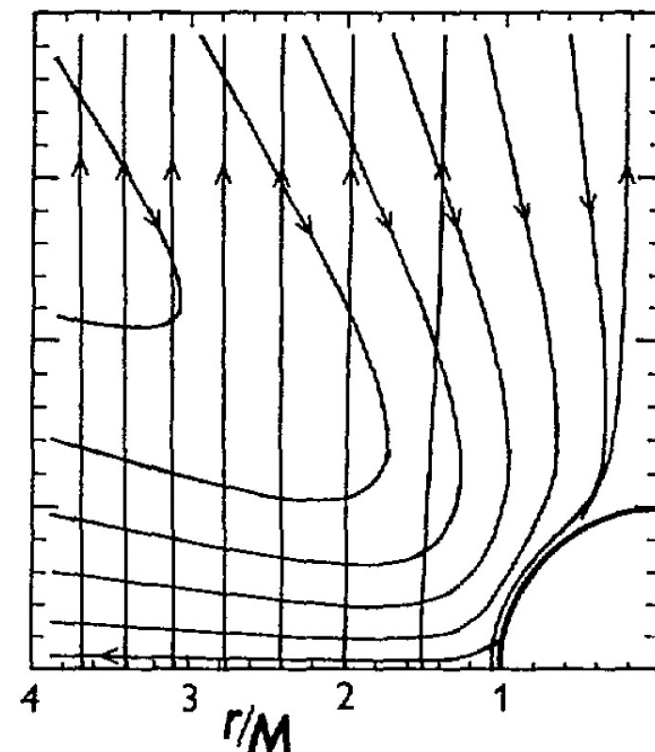
$$ds^2 = -e^{2\nu} dt^2 + e^{2\psi} (d\varphi - \omega dt)^2 + e^{2\lambda} dr^2 + e^{2\mu} d\theta^2$$

$$\begin{aligned} e^{2\nu} &= |\Lambda|^2 \Sigma \Delta A^{-1}, & e^{2\psi} &= |\Lambda|^{-2} A \Sigma^{-1} \sin^2 \theta, \\ e^{2\lambda} &= |\Lambda|^2 \Sigma \Delta^{-1}, & e^{2\mu} &= |\Lambda|^2 \Sigma, \\ \Sigma &= r^2 + a^2 \cos^2 \theta, & \Delta &= r^2 - 2Mr + a^2 + e^2, \\ A &= (r^2 + a^2) - \Delta a^2 \sin^2 \theta, & \Lambda &= 1 + B_0 \Phi - \frac{1}{4} B_0^2 \mathcal{E}. \end{aligned}$$

...exact solution of Einstein-Maxwell eqs.



a)



b)

Fig. 1. — Two typical configurations of the magnetic and electric lines of force near an extreme [$e = - (M^2 - a^2)^{1/2}$], magnetised Kerr-Newman black hole with $\beta = 0.018$, $a/M = 0.99$ (a), and $\beta = 0.071$, $a/M = 0.99$ (b). The latter case corresponds to an uncharged configuration, $e + 2 B_0 M a = 0$. Far from the hole the magnetic lines of force become uniform and parallel to the rotation axis, which goes vertically in the figure. Figures are symmetric with respect to the equatorial plane and axially symmetric about the rotation axis. Near the horizon (denoted by the quadrant $r/M = 1$) they obviously have a dipole-like structure (a), but in an uncharged extreme configuration (b) the magnetic field lines are expelled out of the horizon completely. Electric lines of force are in both cases asymptotically radial. In (b) their shape, unexpected on the basis of our experience with an analogous problem from the classical electrodynamics of rotating magnetised spheres (cf. Thorne *et al.* [23]), is produced by the effects of the gravitomagnetic interaction.

Plasma horizon: $|\mathbf{E} \times \mathbf{B}| = E^2$ (Ruffini, Damour)

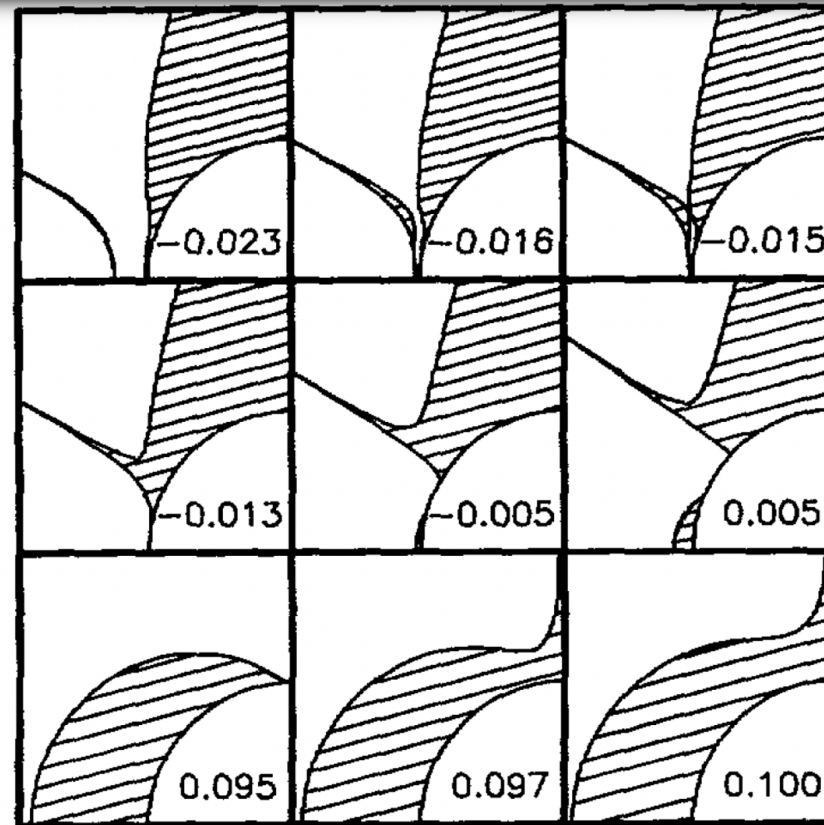
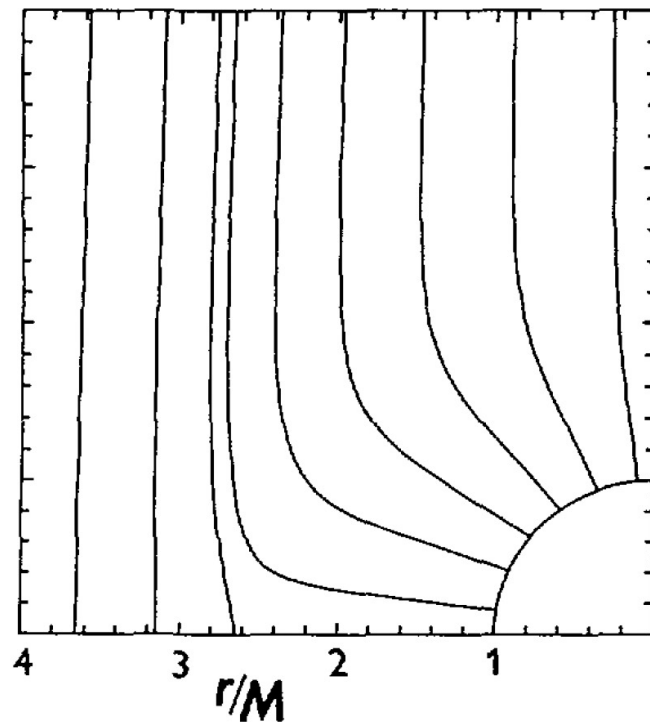
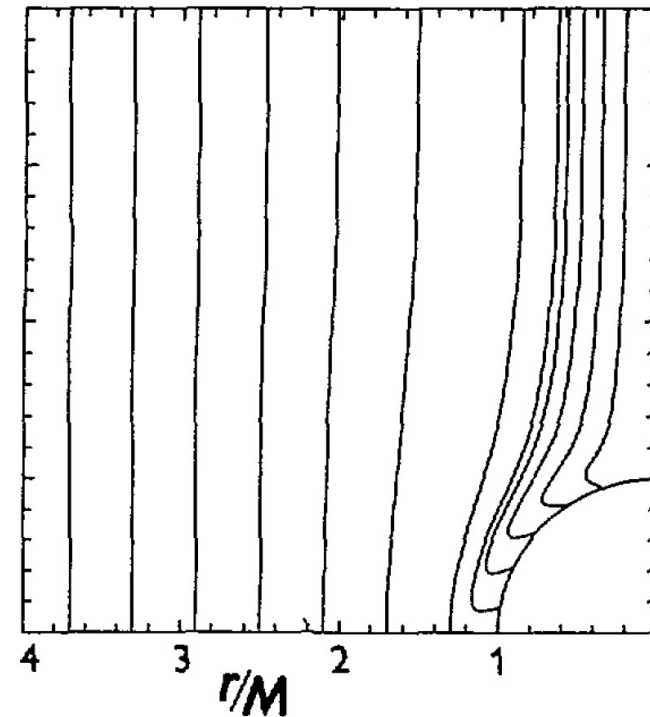


Fig. 2. — Plasma horizons in the MKN space-time with $\beta = 0.05$ and $a/M = 0.95$. Hatching denotes the unstable regions with $V_\alpha V^\alpha < 0$ as defined by equation (7). The black hole horizon is denoted by a quadrant in each figure. The values of e/M are shown with figures : $e/M > 0.095$ corresponds to the positive total charge of the black hole ; this case was discussed by Hanni [14] in detail.

Plasma flow lines: guiding center approximation



a)



b)

Fig. 3. — Typical configurations of the plasma flow lines near an extreme MKN black hole with $\beta = 0.018$, $a/M = 0.090$ (a), and $\beta = 0.05$, $a/M = 0.933$ (b).

...in asymptotically non-flat BH spacetimes

Happy birthday to prof. Remo Ruffini!

On the BdHNI GRB 190114C
and its energetics

Remo Ruffini
and collaborators

ICRANet Pescara – Nice – Rio – Rome – Yerevan
ICRANet / INAF / ICRA

Opawa – RAGtime21 meeting – September 18, 2019



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