The general approach

Consider the Maxwell equations in a material medium

\[ P^{\alpha\beta} ;_{\beta} = J^{\alpha}, \quad (\ast F)^{\alpha\beta} ;_{\beta} = 0, \]

In the limit geometrical optics, take the Hadamard conditions

\[ [E_{\alpha,\beta}]_{\Sigma} = e_{\alpha} k_{\beta}, \]
\[ [B_{\alpha,\beta}]_{\Sigma} = b_{\alpha} k_{\beta}, \]

\[ k_{\mu} \equiv \partial_{\mu} \Sigma \]
For a generic medium, the dispersion relation is

$$\hat{g}^{\mu\nu} k_\mu k_\nu = 0$$

In the absence of magnetic fields, with permittivity $\epsilon(E)$ and permeability $\mu(\varepsilon)$

$$g_{\alpha\beta} = \gamma_{\alpha\beta} - \left[ 1 - \frac{1}{\mu(\epsilon + \epsilon' E)} \right] v_\alpha v_\beta + \frac{\epsilon' E}{\epsilon + \epsilon' E} \hat{l}_\alpha \hat{l}_\beta.$$
Description of the model*

Identifying the effective metric with a black hole

\[ g^{\alpha\beta} = \text{diag} \left( \frac{1}{A}, -A, -\frac{1}{r^2}, -\frac{1}{r^2 \sin^2 \theta} \right), \]

\[ \frac{E}{E_0} = \pm \frac{(1 - A)}{A}, \]

\[ D = \epsilon_0 E_0 (1 - A), \]

\[ \rho = \epsilon_0 E_0 \left[ \frac{2(1 - A)}{r} - \frac{dA}{dr} \right], \]

*EB et al., accepted in CQG, arXiv 1401.7544 [gr-qc]
Concluding Remarks

- A dielectric medium at rest with an exact effective black hole metric is shown.
- All measurable physical quantities are finite.
- It is easy to see that this medium can be done in laboratory.

References

- E. Goulart, Talk at GRACO I, Foz do Iguaçu, Brazil.
- Front image: http://backreaction.blogspot.it; Back Image: Ute Kraus, Physics Education Group (Kraus) Universität Hildesheim, Space Time Travel.