In this work, we study the Unruh effect from the point of view of electrodynamics. You can get a formula for the specific conductivity of the Unruh vacuum.
In this work, we study the Unruh effect from the point of view of electrodynamics. It was suggested that the Unruh vacuum has thermodynamic properties. For example, the temperature of the vacuum to accelerated frames of reference is determined by the value of acceleration

\[ T = \frac{\hbar g}{2\pi kc} \]

Undoubtedly, this conclusion is based on the fact that the physical vacuum is in polarization under the action of the field strength of inertia. Virtual particles are constantly created and destroyed in a vacuum, their energy can change under the action of external fields.

On the other hand, we can consider the vacuum as the sum of various virtual particles and antiparticles as photons, electrons, positrons, and some. For example, the virtual electron can farther removed from the place of his birth, than virtual proton according to the formula of radius Compton wavelength.

\[ R = \frac{\hbar}{mc} \]

Virtual electrons in the accelerated frame of reference shifted stronger than virtual protons, and thus it gives rise to an electric dipole in vacuum.

Thus, the electrodynamic properties of the vacuum to accelerated frames of reference differ from inertial motion with constant speed. Virtual particles are constantly appearing and disappearing in a vacuum, so the virtual electric dipoles (electron and proton) behave also. This is analogous to the emergence of an alternating electric field in the capacitor. Let's call it a virtual capacitor Unruh vacuum. Capacitance and resistance of a capacitor will be:

\[ C = \frac{q}{U} \quad Z = \frac{1}{\omega C} \]

The displacement current in the capacitor is determined by Ohm's law.

\[ I = \frac{U}{Z} = q\omega \]

On the other hand, the vacuum is a continuum and it is convenient to define the density of the bias current according to the law.

\[ j = \gamma \cdot E \]
The current in this case will be integrated value.

\[ I = \gamma \cdot \int E dS = \gamma \frac{q}{\varepsilon_0} \]

Combining this expression with Ohm's law for a capacitor.

\[ I = \gamma \frac{q}{\varepsilon_0} = q \omega \]

You can obtain the conductivity of the vacuum polarization:

\[ \gamma = \varepsilon_0 \omega \]

\( \varepsilon_0 \) - electric constant, \( \omega \) - the frequency of the alternating electromagnetic field in the polarized vacuum.

Then the question arises. Is there such an electromagnetic field in the vacuum to accelerated frame of reference?

The answer is positive. This electromagnetic field is called the Unruh radiation. Though it has a thermal character, but the reason for her appearance in the accelerated reference frame is the vacuum polarization in a field of inertia. Therefore, it is logical to find the frequency of electromagnetic radiation Unruh.

\[ \omega = \frac{E}{\hbar} = \frac{kT}{\hbar} = \frac{g}{2\pi \cdot c} \]

Knowing this ratio

\[ \gamma = \varepsilon_0 \omega \]

Then, finally you can get a formula for the specific conductivity of the Unruh vacuum.

\[ \gamma = \frac{\varepsilon_0 \cdot g}{2\pi \cdot c} \]

As can be seen, the electrical conductivity of the physical vacuum in the accelerated reference frame is proportional to the acceleration.

Example. Consider the gravitational field at the Earth's surface. You can calculate the conductivity of the physical vacuum with the free fall acceleration \( g = 9.98 \). \( 2 \cdot 10^9 \) (ohm m)^{-1}

\[ \gamma = \frac{\varepsilon_0 \cdot g}{2\pi \cdot c} = \frac{8.854 \cdot 10^{-12} \cdot 9.98}{2\pi \cdot 3 \cdot 10^8} \approx 4.69 \cdot 10^{-20} \text{ (ohm m)^{-1}} \]

The amount is quite small. For the experimental measurements can be checked at high accelerations, for example, near the massive and neutron stars.