

# Can the ball lightning be the manifestation of a micro black hole?

## Abstract

The physical nature of the ball lightning (BL) is still the mystery regardless of several proposed theories. The hypothesis stating that the BL can represent the “micro black hole” (MBH), which, interacting with the terrestrial gravity force, generates the directed radiation, which allows it to “levitate”, deserves special interest. Having taken this possibility into account, the analysis had been held with regard to the ability of the MBH to generate electromagnetic radiation (ER) for “levitation”, with the BL weighing one gram as a basic point. Additionally, the duration of its potential lifecycle is evaluated. The performed calculations attest to the fact that the BL cannot represent the MBH.

**Keywords:** The ball lightning, micro black holes, electromagnetic radiation

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## Introduction

The ball lightning (BL) is quite a rare atmospheric phenomenon.<sup>1</sup> Its physical nature still remains a mystery. The variety of ball lightning theories had been proposed for the past several years, but unfortunately, none of them cannot describe all the observable parameters of this natural phenomenon. Rabinowitz<sup>2</sup> proposed an interesting hypothesis that the BL is the micro black hole (MBH).<sup>2</sup> According to Hawking hypothesis,<sup>3</sup> the MBHs are not stable and subject to some sort of “evaporation” with intensity inversely proportional to square diameter of the MBH. Thus, the existence of the MBH is considered impossible. Rabinowitz<sup>2</sup> had rejected the hypothesis of the MBH “evaporation” proposed by Hawking, however, he suggested that the “evaporation” of the MBH existed as radiation and was caused by the tunnel effect originating from the interaction of the gravitational fields of the Earth and the MBH. At that, the radiation of the MBH is directed along the interaction line, that is towards the center of the Earth. Rabinowitz<sup>2</sup> considers that the radiation can possess such a significant intensity that the obtained reactive power is capable of causing the “levitation” of the MBH above the surface of the Earth. Such phenomenon can be observed as a light ball-shaped object capable of hovering and flying in different directions. It is definitely similar to the BL phenomena observed by numerous witnesses.

## The micro black hole

Based on the eyewitnesses testimonies, the main physical parameters of the BL had been established: the energy contained in the BL: from 0.1 to 4 kWh; its lifecycle: from few seconds to several minutes; the weight: from 0.5 to 50g; its density: from 0.0013 to 0.015 g / cm<sup>3</sup>.<sup>1</sup> Considering that there is no clear definition of the main emission type radiated by the BL, we can suggest that the micro black hole (MBH) evaporation is electromagnetic radiation (ER). We will try to calculate the dimension of the MBH as well as the power of the ER, which shall be generated to overwhelm the terrestrial gravity force; first, considering the BL weighing one gram as a basic point, and taking into account the hypothesis that the BL is the result of the manifestation of the MBH according to Rabinowitz hypothesis.<sup>2</sup> For estimation of the MBH size we will calculate its gravitational radius first (the Schwarzschild radius):

$$r_g = 2GM_{bh} / c^2,$$

where  $r_g$  – gravitational radius (m);  $G = 6.67430 \times 10^{-11}$ ,

$N \times m^2 \times kg^{-2}$  – gravitational constant,  $M_{bh}$  – the mass of the MBH(kg),  $c = 3 \times 10^8$ m/s.

This expression is usually represented as follows:

$$r_g \approx 1.48 \times 10^{-27} \times M_{bh}, m. \quad (1)$$

For the MBH with the mass of 1 g, which is 0.001 kg, we receive  $r_g = 1.48 \times 10^{-30}$  m.

As a comparison: the size of the hydrogen atom radius  $r_H = 5.3 \times 10^{-11}$  m, proton radius (atom nucleus of the hydrogen atom) equals to  $r_p = 8.8 \times 10^{-16}$  m. It is clear that the size of the MBH weighing 1 g is almost 15 orders less than the size of proton and almost 19 orders less than the size of hydrogen atom. It is the evidence of the negligibly low probability of the interaction of such black hole with the material atoms, that means that the “additional charging” of the MBH is highly improbable. The only “evaporation” is possible for the MBH. Now we will calculate the power of the ER which should be generated by the MBH to overwhelm the terrestrial gravity force.

The terrestrial gravity force towards the MBH can be defined by the common formula:

$$F_g = M_{bh} \times g \quad (2).$$

Where  $g = 9.8$  m/s<sup>2</sup> – gravitational acceleration of the Earth.

Hence the terrestrial gravitational force applied to the MBH weighing one gram equals to:

$$F_g = 0.001kg \times 9.8m / s^2 = 0.0098N.$$

For gaining the “levitation” effect this force must be counterbalanced by the reactive power generated by the ER, namely by the photons directed by the MBH towards the center of the Earth.

Let's evaluate the power of the ER generated by the "evaporating" MBH.

The impulse of the photon  $p$  is defined by the expression:

$$p = h\nu / c,$$

where  $h$  – Plank constant,  $\nu$  – photon frequency (this value is not applicable hereinafter),  $c$  – light velocity ( $3 \times 10^8$  m/s). If we define the number of the photons generated by the MBH per second as  $N$ , then the reactive power  $F_p$  will be defined by the formula as follows:

$$F_p = N \times p = N h\nu / c \quad (3).$$

As far as  $\nu$  – the energy of a single photon, then  $N h\nu$  – the energy of all photon per second, namely it is the power of the radiation  $P_\Sigma$ . Then the formula (3) can be revised as follows:

$$F_p = P_\Sigma / c \quad (4).$$

To gain the "levitation" of the MBH the condition  $F_p \geq F$  must be fulfilled, otherwise considering (2) and (4) we receive following in equation:

$$P_\Sigma \geq (M_{bh} \times g) \times c \quad (5).$$

The value for  $M_{bh} \times g = F_r$  for the MBH weighing 1 gram was already calculated, then we receive:

$$P_\Sigma \geq 0.0098 \times N \times 3 \times 10^8 \text{ m/s} \approx 3 \times 10^6 \text{ W} = 3 \text{ MW}.$$

However, one more essential question arises whether such radiation power is possible during the levitation of the BL. The value of 3MW is the power of radiation which is capable of causing the instant thermal damages of any physical objects being in close contact with the BL. Most likely it means that the mass of the BL must be significantly less than one gram. It is a question, which mass the MBH should have if we still follow the accepted hypothesis about the electromagnetic nature of the radiation for the "levitation".

According to the witnesses' testimony, the warmth, namely the infrared radiation generated by the ball lightning can be perceived by the person at a distance of approximately 0.5 meter.<sup>1</sup> Thus, if we take the usual cooktop of the electric oven with the capacity of 600W, then its radiated heat also can be perceived at a distance of  $\sim 0.5$  m. Taking into account these facts, based on the subjected perception, we will try to accept  $P_\Sigma = 600\text{W}$  as a limit value for the power of radiation generated by the MBH. Now the formula (5) is suitable for modifying as follows:

$$Mbh \leq P_\Sigma / (g \times c) \quad (6).$$

Therefore, we calculate the limit value for the mass of the MBH based on the power value accepted herein:

$$Mbh \leq 600 \text{ W} / (9.8 \text{ m/s}^2 \times 3 \times 10^8 \text{ m/s}) = 2.04 \times 10^{-7} \text{ kg} = 0.2 \text{ mg}.$$

The radius of such MBH according to (1) is as follows:

$$r_g \leq 1.48 \times 10^{-27} \times 2.04 \times 10^{-7} = 3.02 \times 10^{-34} \text{ m}.$$

This value is more than 18 orders less than the size of the atom nucleus of the hydrogen atom (proton), which dismisses the possibility of the "additional charging" of the MBH.

## Conclusion

We will try to estimate the potential lifecycle of such an object in case we accept the thesis of (2001), rejecting the MBH "evaporation" hypothesis proposed by Hawking, and thus denying the conclusions that the speed of the MBH "evaporation" is inversely proportional to its mass. Based on general formula  $E=mc^2$ , we calculate the internal energy of the MBH, which needs to be consumed for "levitation":

$$E = 2.04 \times 10^{-7} \text{ kg} \times (3 \times 10^8 \text{ m/s})^2 = 1.8 \times 10^{10} \text{ J} \quad (7).$$

We will estimate the lifecycle  $\tau$  of such MBH. To do this we will consider that the power of radiation of the MBH weighing  $2.04 \times 10^{-7}$  kg is still 600W. As far as the expression  $E=P_\Sigma \times \tau$  is true for the radiation energy, then:

$$\tau = E / P_\Sigma = 1.8 \times 10^{10} \text{ J} / 600 \text{ W} = 3 \times 10^7 \text{ s} = 0.83 \times 10^4 \text{ hour} = 3.46 \times 10^2 \text{ days} = 1 \text{ year}.$$

Therefore, the period of interaction of the MBH in a shape of the BL with the terrestrial gravity force amounts almost one year. However, based on numerous observations of the witnesses, there had never been any observed BL with such a long life cycle.

Based on the performed calculations, the BL cannot be the MBH. We will emphasize once again that the conclusions are made based on the hypothesis that the radiation causing the "levitation" of the BL, has the electromagnetic nature.

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## Conflicts of interest

The author declares that there is no conflict of interest.

## References

1. Stakhanov IP. The Physical Nature of Ball Lightning. Moscow: Atomizdat, Russian, 1979.
2. Rabinowitz M. Ball Lightning Manifestations of Cosmic Little Black Holes. *Astrophysics and Space Science*. 2001;277:409–426.
3. Hawking SW. Particle creation by black holes. *CommMath Phys*. 1975;43:199–220.