

MICROGRAVITY SCIENCES AND PROCESSES (A2)  
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OPTIMAL BLACK HOLES

**Abstract**

Let's call the black hole optimal under which information content is minimal at the Universe region of mass  $M$  and at the Universe as a whole, consisting of usual substance and one black hole. The origin and cause of optimal black holes existence is the occurrence of substance of two different types: with square-law and linear-law dependence of information content on mass. In the presence of substance of only one type, the optimal black holes do not exist.

Let's estimate the information content of the Universe region of mass  $M$  under the arbitrary square-law relation between information and energy(mass) of the black hole  $I_{bh}=aM^2bh$ .

And arbitrary linear-law relation between information and energy (mass) of usual substance  $I_{us}=bM_{us}$ .  $M_{bhopt}=b/2a$  is black hole mass, under which information content of the Universe region of mass  $M$  consisting of usual substance and one black hole is minimal. Information content of optimal black hole is proportional to squared coefficient correlating information content with mass in usual substance and in inverse proportion to coefficient correlating information content with black hole mass:  $I_{bhopt}=b^2/4a$ .

The maximum number of optimal black holes of the Universe is equal to  $M_{bhopt}=M_{un}/M_{bhopt}=2aM_{un}/b$ .

Minimal information content of the Universe consisting of optimal black holes only is twice less than information of the Universe of the same mass filled with usual substance only  $I_{unbh}=bM_{un}/2$ .

Concentration of mass  $M_{bhopt}=hc^3/8\pi^2GkT(11,422ln2hc/4\pi MpG)$  of optimal black hole minimizes information content in the system "radiation-black holes" {R-BH} ("hydrogen(proton)-black holes" {H-BH}).

The mass of black hole under which the information minimum is gained in Universe is equal to  $9,09E+22kg$  (at  $T=2,7K$ ) {R-BH} ( $1,78E+11kg$  {H-BH}).

Information content of optimal black hole is equal to  $I_{bhopt}=1,26E+62bits$  {R-BH} ( $3,76E+38bits$  {H-BH}).

Our Universe can contain about  $1E+29$  {R-BH} ( $1E+41$  {H-BH}) optimal black holes. The minimal information content in Universe of the mass equal to  $1E+52kg$ , if it consists from optimal black holes, and only from them, is equal to  $1,56E+91$  {R-BH} ( $3,31E+79bits$  {H-BH}).

Under the radiation temperature  $T=1,55E+12K$  the mass of optimal black holes that emerged in the systems {R-BH} is equal to the mass of optimal black holes that emerged in the systems {H-BH}.

If optimal black holes are shaped of various types of atoms of usual substance or mixture of various types of atoms of usual substance masses of optimal black holes and information contents in them are approximately equal.

1. Gurevich I. The laws of informatics-the basis of structure and knowledge of complex systems. Torus Press. Moscow. 2007 (in Russian).

2. Gurevich I. About restrictions on volume of the information in the Universe. 58th International Astronautical Congress-2007(IAC 2007).