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BOSE INSTABILITY AND PHOTOIONIZATION OF BOUND LEVELS OF COSMOLOGICAL BLACK HOLES BY HAWKING RADIATION

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Bose instability of rotating (Kerr) and charged (Reissner–Nordström or Kerr–Newman) Black Holes (BH) [1–3] is related to the increase with time ($\sim s^{\lambda t}$) of small perturbations of Bose mass field, corresponding to superradiative, quasi-bound states with energies $E \leq \{\mu, m\Omega_H\}$, where $\Omega_H = a/2Mr_+$ is the angular velocity of the BH [4]. The dumping of the angular momentum of the BH is due to the occurrence of processes of self-induced production of boson pairs and accumulation of bosons in superradiative quasi-levels. The minimal time of the dumping of the angular momentum in the envelope $t_{\min} \sim 96\mu^{-7}M^{-8} \ln(M/M_{\text{pl}})$ for $\mu M \ll 1$ (the system of units $c = h = G = 1$ is used) may be much less than the time of the dumping of the angular momentum by superradiation.

The analysis of boson (scalar) instability for charged BH's shows that

- i) the Reissner–Nordström BH is stable, because there are not superradiative quasi-bound levels in this case;
- ii) Boson instability of the Kerr–Newman BH is due exclusively to the rotation of the BH, implying the dumping of the angular momentum;
- iii) Bose instability may cause an increase of the charge of a BH until the strong electro-dynamical discharge by pairs production begins [5–6].

Using the well-known results of quantum electrodynamics for hydrogen-like atoms in flat space-time for the estimation of the cross section of photoionization for electrically charged particles on bound orbits near a black hole, one can obtain for the 2P level:

$$\sigma_A(\omega) = \frac{2^8 \alpha (I_{\text{ion}}^{2p})^{7/2}}{3\mu (t_i \omega)^{9/2}}.$$

The ejection rate for such particles, accumulated near a rotating primordial black hole, as a result of superradiative instability, is estimated to be very high due to Hawking's electromagnetic radiation [7].

References

1. Kerr, R.P. (1963) *Phys. Rev. Lett.* **11**, 237.
2. Reissner, H. (1916) *Ann. Physik.* **50**, 106;
Nordström, G. (1918) *Proc. Kon. Ned. Acad. Wet.* **20**, 1238.
3. Newman, E. T., Couch, E., Chinnapared, E. et al. (1965) *J. Math. Phys.* **6**, 918.
4. Gaina, A. B. (1989) *Pis'ma Astron. Zh.* **12**, 946.
5. Gibbons, G. W. (1975) *Commun. Math. Phys.* **44**, 245.
6. Hawking, S. W., (1974) *Nature* **248**, 30;
(1975) *Commun. Math. Phys.* **43**, 199.
Page, D. N. (1976) *Phys. Rev.* **D13**, 198.
7. Gaina, A. B. (1992) (to be published) and *Stud. Cercet. Fiz.* **44**, 585; (1992) *General Relativity and Gravitation 1992*; (1992) *Proc. of the International Conference GRI, Cordoba, Argentina*; Gleizer, R. G., Cozameh, C., and Moreschi, O. M. (eds.) (1993) *IOP Publishing*, p. 384.