Corda, Christian
On quasi-normal modes, area quantization and Bohr correspondence principle. (English)
Zbl 1323.83018
Int. J. Theor. Phys. 54, No. 10, 3841-3849 (2015).

Summary: In [Int. J. Mod. Phys. D 14, No. 1, 181–183 (2005; Zbl 1071.83542)], the author I. B. Khriplovich verbatim claims that “the correspondence principle does not dictate any relation between the asymptotics of quasinormal modes and the spectrum of quantized black holes” and that “this belief is in conflict with simple physical arguments”. In this paper we analyze Khriplovich’s criticisms and realize that they work only for the original proposal by Hod, while they do not work for the improvements suggested by Maggiore and recently finalized by the author and collaborators through a connection between Hawking radiation and black hole (BH) quasi-normal modes (QNMs). This is a model of quantum BH somewhat similar to the historical semi-classical model of the structure of a hydrogen atom introduced by Bohr in 1913. Thus, QNMs can be really interpreted as BH quantum levels (the “electrons” of the “Bohr-like BH model”). Our results have also important implications on the BH information puzzle.

MSC:
83C57 Black holes
83C47 Methods of quantum field theory in general relativity and gravitational theory

Keywords:
effective temperature; Hawking radiation; quantum levels; quasi-normal modes; Bohr-like black hole model

Full Text: DOI arXiv

References:
[1] Motl, L.: Adv. Theor. Math. Phys. \textbf{6}, 1135 (2003)
[2] Motl, L.; Neitzke, A, No article title, Adv. Theor. Math. Phys., 7, 307, (2003)- doi:10.4310/ATMP.2003.v7.n2.a4
[3] York, J. Jr.: Phys. Rev \textbf{(D28)}, 2929 (1983)
[4] Hod, S.: Phys. Rev. Lett. \textbf{(81)}, 4293 (1998)
[5] Hod, S, No article title, Gen. Rel. Grav., 31, 1639, (1999) - Zbl 1081.83523 - doi:10.1023/A:1026753914838
[6] Maggiore, M.: Phys. Rev. Lett. \textbf{(100)}, 141301 (2008)
[7] Zhang, B; Cai, Q-Y; You, L; Zhan, MS, No article title, Phys. Lett. B, 675, 98, (2009)- doi:10.1016/j.physletb.2009.03.082
[8] Zhang, B; Cai, Q-Y; Zhan, MS; You, L, No article title, Ann. Phys. 326, 350, (2011) - Zbl 1210.83030 - doi:10.1016/j.aop.2010.11.015
[9] Zhang, B; Cai, Q-Y; Zhan, MS; You, L, No article title, EPL, 94, 20002, (2011)- doi:10.1209/0295-5075/94/20002
[10] Zhang, B; Cai, Q-Y; Zhan, MS; You, L, No article title, Int. Journ. Mod. Phys. D, 22, 1341014, (2013) - Zbl 1278.81047 - doi:10.1142/S0218271813410149
[11] Corda, C.: Int. Journ. Mod. Phys. D \textbf{(21)}, 1242023 (2012). (Honorable Mention in the Gravity Research Foundation Essay Competition)
[12] Corda, C, No article title, JHEP, 08, 101, (2011) - Zbl 1298.83047 - doi:10.1007/JHEP08(2011)101
[13] Corda, C, No article title, Eur. Phys. J. C, 73, 2665, (2013)- doi:10.1140/epjc/s10052-013-2665-6
[14] Corda, C; Hendi, SH; Katebi, R; Schmidt, NO, No article title, JHEP, 06, 008, (2013) - Zbl 1342.83115 - doi:10.1007/JHEP06(2013)008
[15] Corda, C; Hendi, S.H.; Katebi, R., Schmidt, N.O.: Adv. High En. Phys., 527874 (2014)
[16] Bekenstein, JD, No article title, Lett. Nuovo. Cim., 11, 467, (1974)- doi:10.1007/BF02762768
[17] Bohr, N, No article title, Zeit. Phys., 2, 423, (1920)- doi:10.1007/BF01329978
[18] Bohr, N, No article title, Philos. Mag., 26, 1, (1913)- doi:10.1080/14786411308634955
[19] Bohr, N, No article title, Philos. Mag. 26, 476, (1913)- doi:10.1080/14786411308634993
[20] Dreyer, O.: Phys. Rev. Lett. \textbf{(90)}, 081301 (2003)
[21] Khriplovich, I.B.: Int. Journ. Mod. Phys. D \textbf{(14)}, 181 (2005)
[22] Parikh, M.K.: Gen. Rel. Grav. \textbf{36}, 2419 (2004). (First Award in Gravity Research Foundation Essay Competition)

[23] Parikh, MK, Wilczek, F, No article title, Phys. Rev. Lett., 85, 5042, (2000) - Zbl 1369.83053 · doi:10.1103/PhysRevLett.85.5042

[24] Hawking, S.W.: Commun. Math. Phys. \textbf{43}, 199 (1975)

[25] Corda, C.: Ann. Phys. \textbf{337}, 49 (2013). Definitive version with corrected typos in arXiv:1305.4529v3

[26] Hawking, S.W.: Phys. Rev. D \textbf{14}, 2460 (1976)

[27] Corda, C.: Ann. Phys. \textbf{353}, 71 (2015)

This reference list is based on information provided by the publisher or from digital mathematics libraries. Its items are heuristically matched to zbMATH identifiers and may contain data conversion errors. It attempts to reflect the references listed in the original paper as accurately as possible without claiming the completeness or perfect precision of the matching.