AMO QUANTUM OPTICS SEMINAR SERIES

BLACK HOLE ENTROPY:

from a quantum optical perspective

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ABSTRACT

Hawking black hole (BH) radiation is emitted when particles tunnel from the inside through the event horizon to the "outside world". We here show that atoms falling from outside through a Schwarzschild horizon emit a kind of Unruh acceleration [1] radiation which to a distant observer looks much like Hawking radiation [2]. In particular, we find the entropy of the acceleration radiation via a simple laser-like analysis.

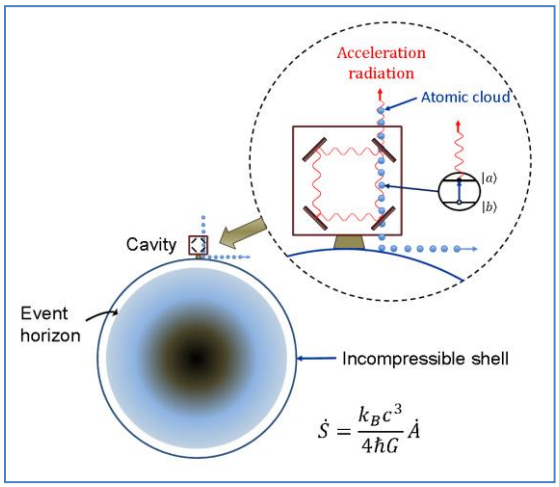

FIGURE: Ring cavity in a box is held above a BH by an incompressible shell that surrounds the event horizon. A BH is bombarded by a pencil-like cloud of two level atoms that are falling through a cavity and then deflected away from the BH by the incompressible shell. The relative acceleration between the atoms and the field yields generation of Unruh acceleration radiation. The physics of the acceleration radiation process corresponds to the excitation of the atom together with the emission of the photon. The entropy flux of the emitted radiation $\dot{S}$ is connected to the time rate of change of the BH area $A = 4\pi r_s^2$, where r_s is the Schwarzschild radius.

Tuesday, May 8, 2018

12:00 Noon

IQSE Seminar Room (578 MPHY)

(Sandwiches, salad, and soda served at 11:30 a.m.)

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[1] M.O. Scully, V.V. Kocharovsky, A. Belyanin, E. Fry, and F. Capasso, "Enhancing Acceleration Radiation from Ground-State Atoms via Cavity Quantum Electrodynamics," Phys. Rev. Lett. 91, 243004 (2003); A. Belyanin, V.V. Kocharovsky, F. Capasso, E. Fry, M.S. Zubairy and M.O. Scully, "Quantum electrodynamics of accelerated atoms in free space and in cavities," Phys. Rev. A, 74, 023807 (2006).

[2] M.O. Scully, A. V. Sokolov, A. Svidzinsky, "Virtual Photons: From the Lamb Shift to Black Holes", Optics and Photonics News, February 2018.