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## **Primordial black holes as Dark matter, gravitational radiation as Dark energy (P.W.Anderson): experimentally and observationally tested unified approach to Planck-scale physics and Big Bang cosmology, early Large-scale structure and Two-stage accelerated expansion of the Universe**

*Tuesday, 9 July 2024 17:30 (20 minutes)*

Recent remarkable discoveries, such as Einstein's gravitational waves, "impossible early" galaxies and quasars, 2D photon Bose-Einstein condensate with rest energy etc. provide a solid experimental and observational basis for "fiery marriage of general relativity with quantum theory" (J.Wheeler).

Consecutively, in a physical logic, nature inspire us that primordial black holes (PBHs) represent 2D spherical photon condensates trapped in their own gravitational fields. Such a physical model inevitably leads to the remarkable equation that directly connects Compton wavelength of condensed light (quantum theory) with geodesical length (general relativity):  $\lambda_{sm}=2\pi R_s$ ,  $R_s$ -gravitational radius of black hole. Figuratively speaking, Spacetime tells condensed Light quanta how to curve; condensed Light quanta tells Spacetime how to quantize.

Relying only on the well-established physical laws one can easily find the numerous quantized characteristics (mass, rest energy, size, entropy, temperature, amount of quantum information etc.) and simple but very important laws that govern birth, growth and death of PBHs. We find that two-particle emission (both outside black hole, accompanied with gravitational radiation) remove so-called "information loss" problem.

Moving backwards along the "arrow of time" we find the "graininess-spacetime" consisting of 3D Planck condensed photons. However, after Big Bang, by the end of Planckian era (at about  $50\pi T_p$ ) we already find continuum spacetime with gravitational radiation (dark) energy density  $\Omega\lambda=0.6777\dots$ . To this very early important moment the first stage of accelerated expansion of the Universe had practically finished. Recent second stage of accelerated expansion is caused by remarkable growth of gravitational radiation (DE) as a result of intense (compare modern  $\Omega\lambda$  estimations with the early 0.6777...) merger processes between current PBHs background (DM) and supermassive black holes in the active galactic nuclei (AGN). Note that modern DM represents asteroid-mass microscopic PBHs which emit "unsolved" diffuse hard X-ray with peak at 30keV and hard cut-off 511keV/2.

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