Quantum Nature of Physical Space, Aristotle Fifth Element or Casimir Vacuum, Connects Constants of Chaos Theory (δ, α) in Mathematics to Universal Gas Constant and Atomic Mass Unit (R^o, *amu*) in Physics SIAVASH SOHRAB, Northwestern University — Physical space, Aristotle fifth element, Casimir vacuum, the primordial void, or *"Tohu Vavohu"* meaning *total chaos* [1], is identified as compressible tachyon fluid, Planck compressible ether, and Lorentz-FitzGerald contractions become causal (Pauli, 1958) in accordance with Poincaré-Lorentz *dynamic* versus Einstein *kinematic* theory of relativity [1]. Closing the gap between radiation and gas theories results in space composed of a spectrum of photon-clusters, Planck "quantum spheres of action" (Darrigol, 1991), with finite gravitational viscosity [2]. Normalized spacing between nontrivial zeros of Riemann zeta function and eigenvalues of GUE (Odlyzko, 1987) are found to follow *Normalized Maxwell-Boltzmann* distribution. Thus, numbers in mathematics are related to counting photons. Constants of chaos theory $\delta = (1 + R^\text{o})/2 = 4.6692$ and $\alpha = 2 + (2m_k c^2 - 0.5 \times 10^{-26})/(m_k c^2 - 0.5 \times 10^{-26}) \approx 2.502904$ are related to De Pretto number 8338 J/kcal (universal gas constant $R^\text{o} = 8338.4$ J/kmol-m) and $amu = m_k c^2 = \sqrt{hkc}$. When *physical space* is identified as a *fluid* with energy spectrum given by Schrödinger equation of quantum mechanics, in view of Heisenberg *matrix mechanics*, it must be described by *noncommutative geometry* [3]. [1] Sohrab, S. H., *Int. J. Thermodynamics* **17**, 233 (2014). [2] 't Hooft, G., *Class. Quantum Grav.* **16**, 3263 (1999). [3] Connes, A., *Lett. Math. Phys.* **34**, 238 (1995).

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