

The Source, the Field or the Metric?

(Part II)

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There are three main “pictures” (interpretations) in physics [1] at the present time. But **the source picture** is the most intuitive (deterministic) original version which is also more suitable for simulations (e.g. the quantum trajectory method, the formation of cosmic objects). Thus it does not need a special explanation.

The field (wavefunction) picture is a potential (probabilistic) point of view (a wave equation transformation of sources) for phenomena comparable with resolution (noise). This picture, which is equivalent to the finite element (Monte Carlo) deterministic simulation, is more popular due to a fascination and the attraction of misunderstanding (e.g. paradoxes). It also provide good results (statistics) but without anything behind it.

The fundamental (charge) particles (like the electron) form all atoms and molecules, but the groups of fundamental particles can be represented by a (non-fundamental) **field** or its change (momentum). This multipole radiation (transformation) can be reinterpreted as quasi-particle (photon, phonon). But there is no (at fundamental level) radiation pressure (pushing) or radiation momentum (photons) as we can see from the paragraphs below:

- All atoms and molecules are the high-field seeking particles in their ground state. The low-field seeking is possible for (e.g. thermally) excited particles with an (weak) anisotropy stored in their nuclei (It can be used for (non-fundamental) particle beam splitting (in an inhomogeneous field) but does not work for electron beams. The “spin” is only a relative transformation from a rotating frame of reference (e.g. a dragging/precession in orbit)).
- An acceleration of charged particles is produced in the (electric) field direction (polarization direction). It is known from accelerators with the transversally propagated laser beam or RF field. (This field is not propagated parallel to accelerated particles.)
- Compton scattering and inverse Compton scattering correspond to non-relativistic Thomson scattering. They are proportional to the polarization direction factor (either as ionization).
- Optical tweezers (trapping) work with the beam propagated in the gravity direction or in the opposite direction as well, and also act in the polarization direction (tangential to the wavefront) and objects moves into the high-field region. (The alternating optical field with femtosecond periods is not fast enough for dielectrics and thus it is able to produce a charge polarization in this medium.) There is a force component (coaxial with the beam) for focused Gaussian beams that draw an object from the beam focus (and could be compensated by gravity).
- The optical cooling is analogical to optical tweezers (trap) in a resonance with energy loss.

- The Poynting–Robertson force corresponds (from aberration) to a transversal gradient of radiation which accelerates orbiting object (to a higher field as in optical tweezers). The full radiation power (without the factor v/c) does not push (nor pull) this object.
- The flux of the vector field is always a tensor (or a pseudovector, a pseudomomentum). Thus the Poynting “vector” is misleading (its value also includes a momentum/energy of material). The true momentum is always relative (as is velocity) and depends on the observer.
- The recent “radiation pressure” experiments (as well as the Nichols radiometer) observe only a (noise excited) periodical mechanical oscillation/resonance (but the acting force is perpendicular like for a vertically-driven pendulum).
- Pressure in e.g., the Crookes radiometer, the solar wind and inside stars is given by the momentum of (“fermionic”) particles. Force in (sub-) nanometric sizes is a more complicated interference of fields (Its momentum is inversely proportional to the wavelength of the field – i.e. the spatial period of dynamic distribution of electric potential in space).
- The Abraham-Minkowski controversy is irrelevant. The crest distance (wavelength) and the electric field intensity are decreased in a dielectric medium. Only the spatial frequency analysis (with the field wavelength modified by “optical” density) can explain effects of the spatial gratings (with pseudomomenta). E.g. the phase matching condition in an anisotropic medium (interpreted as momentum conservation) depends on material properties in the field polarization direction.

From the **wavefunction** (statistic) point of view, we can look at the quantum communication loopholes.

The first loophole is that the standard quantum limit (relatively precisely proved for “large” intensities) is 100% for a single photon. Thus the single photon coding is totally uncertain in amplitude, phase and polarization (the squeezed states record is claimed to be 10 times today). But the quantum key distribution systems “work” with an error rate (for “single” photons) of less than 5%. This discrepancy comes from a slow (relative to the femtosecond wave duration) and interrupted detection (imperfect fidelity).

The second loophole is a contradiction in terms that “the perfect quantum cloning is impossible” and that “the stimulated emission produces photons with same phase, polarization, frequency and direction” (Note that the laser works as “collisional” injection locking between a cavity and a metastable state excited by the electron.). Because the ratio of spontaneous and stimulated emission could be improved by spatial filtering, the standard quantum limit with amplified light could be reached. The single photon cloning is a random process as the single photon properties are random and thus, cannot be used for information transmission and copying is useless.

The third loophole is in detection. It is possible for the (certain) polarization coding transmission (which is transformable to phase coding) to separate states for 45° rotated bases. If we use 45° biaxial crystal, (natural or made by applying a stress, or made as a metamaterial build from periodically rotated sub-wavelength uniaxial plates) certain polarizations travel faster and others slower. Now the secure bits could be resolved in time with respect to a trigger pulse.

We can also apply these loopholes to other “quantum effects”. E.g., in the EPR paradox with multiple “single photons” (no information) we will obtain statistical results as in the single (“multiple photon”) Malus' law experiment. This is possible because any single fundamental charge dipole can (on average) polarize medium according to this continuous law.

The quantum jump (of a single fundamental dipole) has a “transition” time between states (levels) as the (average) time between its excitation and de-excitation but this time does not mean only a (shorter) de-excitation time. The frequency of transition radiation is a beat between orbiting frequencies that is also directly observable in a Rydberg atom (that supports correspondence with “normal” atoms).

Quantum computers require a precision (particles, entropy) better than 2^{bits} . This is not feasible for large numbers because the finite effects in our real world are (and must be) always only polynomial (not exponential as in e.g. the many world interpretation) - e.g. there is *no* exponential screening (but multipole), “normal” or Poisson distribution of “noise” (but binomial), chain-reaction, economical “growth”, butterfly effect. And more, the existence of NP hard (post-quantum) cryptography makes quantum computing potentially impractical.

The metric picture can introduce an illusion of (quantitatively unprovable) singularities in space.

Space should be infinite (it is the most probable case and due to the fact that fundamental particles are known to be stable more than 10^{10} years by many orders) and thus we (and infinite extraterrestrial species) live in a steady state Universe (without the anthropic principle). Its mass density must be finite (e.g. in order 10^{-27} kg/m³) because it corresponds to the finite speed of “time flow” (to the finite and constant entropy density or temperature). The cosmic background radiation (transversal “photonic” and longitudinal “neutrinoic”) corresponds to the binding energy density (also finite without any paradox like e.g. Olbers' and with value in the order of 10^{-30} kg/m³).

The steady state nuclear abundance of elements (and their binding energy) at the present is permanent. The (less abundant) heavier atoms are more easily disintegrated (predominantly by the “galactic” relativistic jets with a mass flux up to the solar mass per year and after this, concentrated in the intergalactic mass) and they are also more slowly “produced” (e.g. in the stellar nucleosynthesis) than lighter atoms (without any creation or destruction of fundamental particles). The nuclear disintegration (“dark stage”) and synthesis are balanced and form the closed cycle of elements (there are no singularities like “black holes” because the internal structure (unknown for the present) of fundamental particles prevent them from this collapse by highly relativistic non-thermal “dark momentum” as is the atomic nucleus [2]). The “dark mass-energy” is the (repulsive, negative accelerating) “strong” interaction and the “visible” (“baryonic”) mass is only the electric (Casimir) contribution ($2\pi\alpha$). On the other hand, the binding radiation is emitted and absorbed (reemitted and reabsorbed) with a zero average of net luminosity (for any “source”). This radiation in the “free stage” represents (conserved) the momentum of a distant mass (the fundamental charge dipoles of neutral Universe).

Gravity is also in balance with the fictitious accelerating expansion of the Universe [3]. And it must be noted that gravitation is not a fundamental force (interaction) and it is only a small correction [4] and thus it can not fundamentally modify space-time.

The force ratio of Unruh radiation for the characteristic size below the Compton length to interaction [5], is about $\alpha^0=1$ (and corresponds to the strong force). This ratio for the Bohr atomic radius is

$$3\left(\frac{2\pi\alpha}{4\pi}\right)^{16} = 3\left(\frac{\alpha}{2}\right)^{16} = 2.96 \cdot 10^{-39}$$

(where α is the fine structure constant) and corresponds to the gravity-strong interaction ratio. We can find that the gravity-electric interaction ratio is

$$3\left(\frac{\alpha}{2}\right)^{15} = 8.11 \cdot 10^{-37} = G \frac{m_n m_n}{r^2} / \frac{1}{4\pi\epsilon_0} \frac{q_e q_e}{r^2}.$$

Thus gravity can be expressed as the unscreened Unruh forcing from atoms [6]. It can be also understood as the Rayleigh to the Thompson scattering ratio.

$$\left(\frac{\omega}{\omega_0}\right)^4 = \left(\left(\frac{\alpha}{2}\right)^2\right)^4 = \left(\frac{\alpha}{2}\right)^8$$

This self-scattering after a renormalization, gives the power of 16. Or if we use the ratio of the (CMB) radiation for renormalized equilibrium to the “rest mass” and then apply the (“elastic”) Rayleigh scattering power of 4, we will obtain a similar formula. This is possible, because we can see, that the energy density of thermal radiation

$$\frac{U}{V} = \frac{8\pi^5 (kT)^4}{15(hc)^3}$$

can be rewritten as (using $kT \rightarrow h\nu$ and $V \rightarrow L^3$)

$$\frac{U}{h} = \frac{8\pi^5}{15} \left(\frac{L}{c}\nu\right)^3 \nu$$

and for the energy ratio (at surface), we will get

$$\frac{U}{h\frac{c}{L}} = \frac{8\pi^5}{15} \left(\frac{L}{c}\nu\right)^4.$$

And also the fraction of power in the Rayleigh scattering at the surface of a particle (with infinite index of refraction) with diameter d is given by

$$\frac{P}{P_0} = \frac{8\pi^5}{15} \left(\frac{d}{c}\nu\right)^4.$$

Thus the brightness temperature of scattering is (relativistic) temperature itself.

- [1] P. Křen: The Source, the Field or the Metric?, 2006, <http://wbabin.net/science/kren3.pdf>
- [2] P. Křen: The Asymmetry is Our World, 2009, <http://wbabin.net/science/kren7.pdf>
- [3] P. Křen: Collapsing Particles, 2008, <http://wbabin.net/science/kren6.pdf>
- [4] P. Křen: Casimir Energy and the Electromagnetic Field, 2009, <http://wbabin.net/science/kren9.pdf>
- [5] Shahar Hod: Unruh radiation: from black holes to elementary particles, 2008 http://arxiv.org/PS_cache/hep-th/pdf/0510/0510089v2.pdf
- [6] P. Křen: The Cosmic Microwave Background Radiation as the Unruh Effect Radiation of Molecular Hydrogen, 2008-2009, <http://wbabin.net/science/kren8.pdf>