

Twin Planetary Inertial Reference Frames; an Orbiting ECI frame and Inner Rotating ECRF.

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Abstract.

We propose that the persistent anomalies of Earth's inertial frame with respect to transitions from the barycentric frame and Laser Lunar ranging findings are due to over simplification. Applying the two inertial system rest frames, representing the orbiting and rotating frames, is proposed as being more consistent with findings and able to remove anomalies. Earth's plasmasphere and ionosphere, essentially a single kinetic system of particles, does not rotate but orbits the sun with the planet at 370kps. The dense 'two-fluid' plasma bow shock and magnetotail are the distinctive features of the non rotating system or Earth Centred Inertial (ECI) Frame. Inside this system and across the stratospheres, a zone referred to as the 'ignorosphere' due to our limited exploration, lies the rotating Earth Centred Reference Frame (ECRF) which includes Earth's atmosphere. The 'scattering surface' system mixing zones at the frame transitions, particularly the bow shock effect the transformation with the mechanism of coupling and re-emission at the local c by all particles. The proposal is consistent with the postulates of Einstein Special Theory of Relativity (SR) and is implemented by the Quantum Mechanisms of fermion conjugate pair production (Unruh Effect) and Raman atomic scattering .

Introduction.

Anomalies with respect to Earth's inertial frame and ecliptic plane have long dogged astronomy and astrophysics. The standard constant for the effect termed 'Stellar Aberration' was abandoned by the International Astronomical Union in it's 2000 resolutions due to inconsistencies. Similar problems, inconsistencies and controversy has arisen regarding the various findings from the NASA Laser Lunar Ranging experiments such as those of Gezari (2009)ⁱ. Only a single Earth centred frame has been assumed, and fears over possible inconsistency with SR have discouraged consideration of real particle scattering boundaries to the inertial system (frame) domains, which Einstein insisted were 'real' not simply mathematical. The 2nd postulate of SR does indeed translate as specifying that "light *propagates* at a certain velocity c " within each system. We are not however discussing SR here, merely demonstrating that the proposal may be consistent with a realistic interpretation if not fully with *the* most popular purely mathematical interpretation. No theoretical problem arises as all scattering at all matter is to local c .

Twin Frames.

We propose that there are two separate Earth centred inertial systems or 'frames'. An inertial system is considered not as an imaginary system of non-existent 'points' and 'lines' but a real particle system with an assignable 'virial' state of motion or rest frame. We have termed such systems '*virial kinetic entities*' (VKE) which have a kinetic state as an average of the particle motion. We have shown how the Lorentz Transformation naturally emerges approaching plasma optical breakdown density and minimum wavelength at frequency γ ⁱⁱ. We term the non-rotating orbiting frame the Earth Centred Inertial ('ECI') frame. The ECI frame extends to the ionosphere/ plasmasphere limit and forms the bow shock at the solar wind interface, spreading out to the magnetotail. The NASA 'Cluster' finding from the shock are consistent but interpreted as electron heating and described as "*poorly understood and controversial*" (Steven Schwartz Imp. Coll. London).

The rotating Earth Centred Reference Frame ('ECRF'), includes the atmosphere and rotates with the planet. There will then be a gradient or 'steps' of diffuse particle inertial states in inner shock toroidal 'rings' or upper atmospheric transition zones. Earth's rotation velocity is very small (<0.465kps) compared to light speed so the effects are only discernible as tiny but non-zero unexplained contributions to scintillation and aberration. Combined with h) above and atmospheric turbulence aberration has led the current Astronomical Almanac (AA2010) model predictions to include for a variable <34 arcmins empirical adjustment for atmospheric refraction effects as derived by Young (2006)ⁱⁱⁱ

CMB.

The ionospheric drag generates the Lense-Thirring inertial frame drag effect and substantial geodetic precession, as predicted in GR, an effect which proved very elusive until NASA's *Gravity Probe B* results (2011)^{iv}. Considered conceptually these results are consistent with different real local inertial 'fields' as domains described by ionospheres, heliospheres and galactic haloes creating all the 'last scattered' CMBR rest frame boundaries implicit in WMAP and Planck findings. Light will pass through each local 'spatial' frame at the local propagation speed c . The optical axis also changes on transition, which is equivalent to refraction. Lateral motion then gives Kinetic Reverse Refraction (KRR), another effect not previously consistently assimilated into theory, where lateral motion of a refractive plane causes a reversal of refraction angle subject to the observer *not* being in the frame of the co-moving medium (avoiding the error made by Lodge in 1893).

Previous 'starting assumptions' did not encourage the option of rotation of emission axis (apparent observed position) after interaction to be considered and evaluated as a solution to Stellar Aberration (with wave theory), the CMBR and wider anomalies. The findings of invisibility optics however (see Zhang et al. 2011)^v have shown that there is no tie between wavefront propagation direction and the optical axis, so allowing this solution. The cause of effect found was derived as an asymmetry of charge density from temporal evolution of interaction by Jackson and Minkowski and is a 'new' rotation of emission axis working alongside interstellar Faraday rotation (IFR) of polarity and deriving elliptical polarisation. The effect needs no experimental verification as it explains and resolves the existing anomalies including KRR. It is termed 'JM rotation' (see; Jackson 2012)^{vi}. The particle field model is consistent with recent Herschel findings (Pineda et al 2013)^{vii} and the cosmological kinetic model of Courtois et al (2013). <http://vimeo.com/64868713>.

Extinction.

The more diffuse the medium the longer the extinction length while birefringence is evident in the medium. This atmospheric birefringence was again first found by Raman in the work leading to his 1930 Nobel Prize. Different magnitudes of rotational 'drag' with altitude is then consistent with

progressive extinction. The concept and dynamic effects may then help explain the inconsistencies between interferometer findings at different altitudes. These aberrations include particularly Dayton Miller Mount Wilson results (1933) of 208km/s >surface 10km/s and Michelson, Pease, Pearson 1929 and Kennedy-Thorndyke 1932; 20-25km/s results, (both with shielded path, not as recommended by Miller). Millers flow axis was found close to Earth's tilt angle, which may only seem explainable by a similar 'partially extinction' effect from the background frame of our galactic arm, through which Earth's path is ~helical. Navia et al (2006), while agreeing with an altitude anisotropy, found a drift more consistent with the CMBR dipole and Mansouri-Sexl (1977)^{viii} test theory one way light speed anisotropy of $c(\theta) = c - v(1 + 2a) \cos \theta$.

Plasma Transition Zone (TZ).

The 'two-fluid' plasma structure and scattering process with annihilation across the Debye length is a constantly regenerating structure of photo-ionization proportional to velocity in the background medium. The infinite hierarchical system of background systems to smaller background systems avoids any theoretical problems with an 'absolute' background frame or 'ether'. Hydrodynamic turbulent mixing characterises the zone between the fluid systems at rest in each frame. The model of discrete systems in relative motion is termed the discrete field model (DFM). Two fluid plasmas are described by Shumalak et al (2004)^{ix} GPS and related evidence is consistent, as discussed in Jackson 2010^x. The structure is also applicable to Maxwell's near/far field transition zone, which would allow the recovery of Snell's Law of refraction, via the change in local c and wavelength which is not possible using current theoretical assumptions. A similar coherent resolution to other non-linear optical effects, interferometer anomalies and the Dynamic Casimir effect is described by Jackson & Minkowski (2012)^{xi} in a paper resolving the anomalies in the falsification of Kantor's emission theory of light and the anomalous reflection from mirrors at apparent $c+v$ in the moving mirror frame.

Conclusions.

We find that a model using two rather than one inertial system 'frames'; able to resolve a wide range of inconsistent findings and anomalies via a model of plasma scattering to local c consistent with Einstein's Special theory of Relativity. The frames are those of the orbiting (outer) *non-rotating* ionosphere plasmasphere particles, and of inner *rotating* atmosphere of earth at rest with the surface. The transition process is largely incomplete due to the small scale of the Earth's systems deriving atmospheric birefringence, scintillation and the unexplained Dayton Miller interferometer result variations with altitude. The NASA *Cluster* probe findings may then be more consistently rationalised as a delta propagation speed to maintain local c and subsequent Doppler shift of wavelength in the rest frames each side of the shock.

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