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Halo Phenomena modeled with Distributed and Quantum Optics given by Electrodynamic Singularities on a Noncircular Orbit

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Abstract:

Propagation and static distribution of light on noncircular orbits are modelled. The space where light embodies is determined with kinematics, such that the perpendicular velocity of the 'material'-space described as a noncircular orbit, is harmonic with amplitude fwr_e. Light propagation to discrete orbits may occur with arbitrary velocity. The modeling serves to describe light when distributed on an arch e.g. rainbow or cloud bow, and when located into more discrete spots. The latter is assumed being present at singularities of the electric field. The assumption of convolution gives propagation of light onto a new noncircular orbit, with solutions of discrete multiple singularities. This is compared with bi-Solars of a Halo. A fine structure will be outlined assuming bi-bi-Solars implied as fractals.

Keywords: noncircular orbit, halo, singularities, electromagnetism, discrete solutions, rainbow, convolution, harmonics, fractal, cycle for f

1. Introduction

Planetary motions are an issue to describe, and results date back to Ptolemaios. With the Kepler solution to Newtonian gravity, the motion of a planet is that of an ellipse, c.f. e.g. Arnold (1978). Mercury is the only planet with large eccentricity, and it is observed that perihelion moves, which indicates that there are also other forces, internal, intrinsic and from outside. Here, we will assume the path of a noncircular orbit, Strömberg (2014; 2015), such that radius vector is given by

$$r = r_o + r_e \sin(fwt) \qquad (1)$$

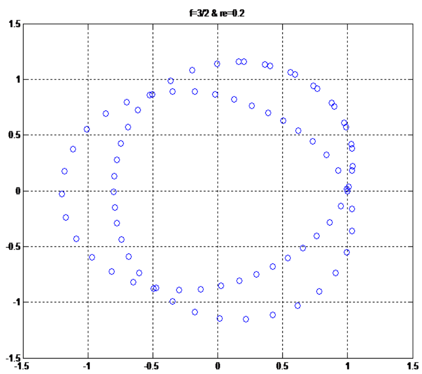

Figure 1. Radius vector for a noncircular orbit, with f=3/2

It is found that this formulation describes many other motions and phenomena e.g. water waves, light and acoustics where 2nd order effects show, Strömberg (2015).

For example in acoustics, the factors f=2, 3/2 and 3 give connections between the frequency and its octave, quint and duodecima.

Such ratios was found by Pythagoras, and later but assumed different by Ptlolemaios, according to Wikipedia. At ionization of oxygen by a magnetic field, similar ratios are found in Northern Light, Figure 2, Strömberg (2015).

Figure 2. Northern Light, mostly green and indigo

The spin orbit ratio 3/2 for Mercury was analysed in Correia and Laskar (2004), by modeling effects of shear deformation.

Dynamical phenomena in fluid structural interaction e.g. Magnus effect for a ball with spin, and uplift on a Ringvinge, may be cast into this framework, Strömberg (2016).

Concepts of memory c.f. Gurtin (1996), Runesson et al (2009), can be expressed in terms of a time invariant, Tti, to a noncircular orbit, Strömberg (2015).

Discrete solutions on an orbit have similarities with star shapes e.g. Charles Vain (Karlavagnen) and Southern Cross, Strömberg (2015; 2016).

Light spots show at the side of the pupil of an eye, which suggests that light takes a circular path on the Iris before entering the pupil, Strömberg (2015; 2016).

According to Huygens principle, light propagates with spherical wave fronts from a source. Hereby, when not constrained, the propagation will be in all directions. The spherical symmetry is often modeled with 1/r singularity, which is a solution to electrostatics. The model is valid far field from the source. For light which we can observe at a location, i.e. reflected on a surface, or from crystals, solutions derived from Maxwell's equation may be descriptive to obtain a spatial distribution. Other models are those of a singularity and its development derived with so called micro local analysis.

In the present paper, we shall propose a model for light on a Halo, by assuming the geometry of a noncircular orbit. The shape relates also to formations and propagation of light in terms of elliptic cavities, as found in accelerators such as Max IV.

2. Model for electromagnetism and propagation of light

Here, we shall consider an electromagnetic field confined to a noncircular orbit (nco). For a nco, the perpendicular velocity is a harmonic, with a dependency on f, r_e and wt, given by time differentiation of r(t) in equation (1) .

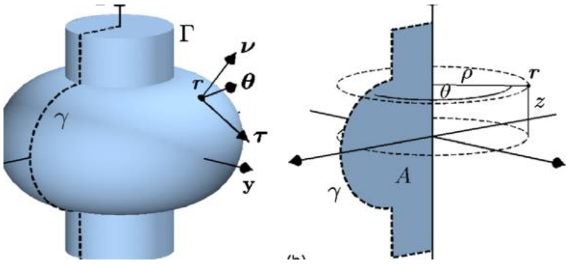

Figure 3. The figure shows elliptic cavities formed by light. Here the boundary curve is modified from an ellipsoidal to a noncircular orbit.

Recent models for propagation of singularities are found in so-called micro local analysis, where e.g. polynomial expressions in time are analysed. Here, the details for a discrete and partly continuous propagation will be derived. Assuming light being governed by Helmholtz' equation, the solutions in Helsing and Karlsson (2016) are applicable. Subsequently, the notations from this will be used, in a brief description, and we consider a plane part of the cavity in cylindrical coordinates, at a constant z coordinate $z=z_0$. The region between (1) and a corresponding circle with radius r_0 will be denoted the 'eccentricity zone', or 'zone'.

Static conditions are assumed inside and time dependency in the eccentricity zone, such that DE = 0 $r<r_0$ for all v, and DE=e(t) $r>r_0$ and $r= r_0$, where v is the angle coordinate on a circle and e(t) is a source term in the eccentricity zone.

Then, the singularity for the electric field, is at r=0. To obtain a propagating singularity (which is identified with a wave front), the fundamental solution and integration will be applied with so-called convolution, for a noncircular orbit such that abs(r-r')=$r_e$sin(fwt), i.e. r is the radius of a nco and r'=r_0.

In the eccentricity zone, we assume time dependency sin $f_1$wt, to fit the format of a noncircular orbit, instead of entire exp(iwt) as in Helsing and Karlsson (2016).

Proposal. With the above preliminaries, the general solution in an eccentricity zone; abs(r-r'), is given as the original time independent field, satisfying the homogenous equation, now scaled with a factor;

$$(\sin(f_1 wt) / \sin(fwt)) \qquad (2)$$

'integrated over' the part of the zone for which the solution is sought.
This is obtained by insertion and convolution of the homogenous solution into the zone.

3. Certain solutions

Theorem 1.(Distributed)

When f_1=f, the factor is constant.

Proof. The factor (2), simply equals 1

Singular points, in time and space: For

$$f=2f_1 \qquad (3)$$

the solution has singularities at discrete values of wt.

Preliminaries. wt will be identified with a location angle v, at the corresponding circular orbit with radius r_0.

Theorem 2. (Discrete, 'quantized') With the above preliminaries, relation (3) and f_1 =1, there will be singularities at discrete equidistant locations in the zone. These are given by v=p/2 and -p/2.

Sketch of Proof. Insertion of (3) in the ratio (2), and evaluation of the trigonometric functions. A cosine-function will remain in the denominator, and this is zero for the angles v=p/($2f_1$) and -p/($2f_1$). In the theorem, f_1 is specified to equal 1, but there are also other possible solutions, e.g. f=2 may give 4 spots.

4. Applications

A light phenomenon on an arc is the rainbow. Then, the solution is distributed on the arc, and not discrete, as it appears. The framework above resulting in Theorem 1, with f_1=f and a small r_e, provides a constant field on a thin almost circular arc. This applies to rainbows and cloud bows.

Another formation is a Halo, consisting of a ring around the sun, with two larger spots with light, c.f. Figure 4. The locations where the new two discrete singularities appear are at 0 and p rad from the horizon, and these are known as bi-Solars. The location agrees with the solution in Theorem 2. Above, there is a so-called circumzenithal arc, which is an upside down rainbow.

Figure 4. Halo phenomena with two bi-Solars

5. Fractal domains to model details of the bi-Solar shape

Next, we will propose a fine structure of the bi-solars. This will be constructed in a similar way which gives bi-bi-solars, as the second level in a fractal. The bi-bi-solars will be assumed with different values of f. As 'candidates' for possible f, we may use common ratios in acoustics, or all f in the cycle Strömberg (2016)$_2$, given by [1,2,0.7,3/2,3]. For the latter case, several bi-bi-solars on rings of certain sizes, may be assumed. This gives patterns as in Figures 5. The value 1, is assumed to appear on all rings

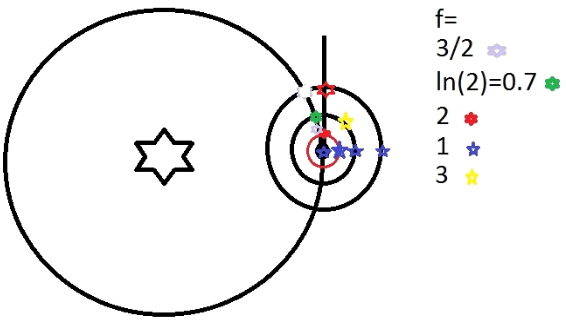

Figure 5.

Another plausible model, is to assume an additional propagation outwards, together with a simultaneously development of two bi-bi-solars inside. With the values of f=2 and 3/2, we get the locations in Figure 6.

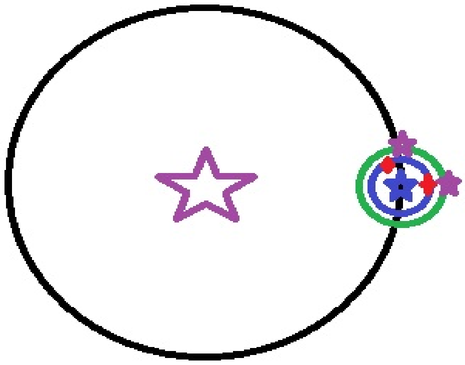

Figure 6.

The singularity for the value 3/2, will overlap the large circle, which agrees with details of the photo, Figure 4. Assuming that the sublevel singularities contribute and move the center of the entire bi-solar, the locations may give a displacement upwards, which also agrees with the appearance for some real configurations, e.g. Figure 4.

6. Conclusion

For the modeling considered here, the solution for the electric field has singularities at discrete f_1wt. Hereby, a singularity for the electric field will propagate to other points, adjacent, at the distance r_0 from the original singularity.

At the radius r_0, for some values of f, the first singularity is multiplied into several singularities, with quantized equidistant locations.

The distance to next (circle of) singularity is not determined and may be given by fractal properties of adjacent geometry with ice crystals. A fractal structure for additional bi-bi-solar was proposed. The location was assumed, induced by the duplicated appearence of the first, but with other f, and smaller radius, such that mostly inside the first 'lightcloud'. The intensity of the singularities on sublevels may be discussed in terms of energy distribution and availibility of new energy at certain locations.

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