duced magnetic fields inside the dipole change according to the classical electrodynamics of Heaviside and, thereby, all electrodynamic phenomena inside the steadily moving dipole also change, which at once destroys the relativistic time-dilation concept.

Heaviside[3] deduced classically the electric field ($\boldsymbol{E}$) and the induced magnetic field ($\boldsymbol{B}^*$) of a point charge (Q) at a point $P(r, \theta, \phi)$ when the charge passes through the origin towards OX with a velocity u in free space, as under:

$$\boldsymbol{E} = \frac{Qk^2\boldsymbol{r}}{4\pi\varepsilon_0 r^3[1-(u^2/c^2)\sin^2\theta]^{3/2}},$$

$$(k = \sqrt{1-u^2/c^2}), \tag{1}$$

$$\boldsymbol{B}^* = (\boldsymbol{u}\times\boldsymbol{E})/c^2, \tag{2}$$

where ε_0 and μ_0 are the permittivity and permeability of free space, and $c = 1/\sqrt{\mu_0\varepsilon_0}$.

Relativists should note that the vital equations (1) and (2) were deduced first not by Albert Einstein from relativity as often tacitly claimed, but by Heaviside from the consideration of classical physics in 1888.

Electromagnetic momentum ($\boldsymbol{P}$) and the magnetic energy (T) of a steadily moving point charge could then be written as

$$\boldsymbol{P} = \int_{\text{all space}} (\boldsymbol{D}\times\boldsymbol{B}^*)\,\mathrm{d}v$$

and

$$T = \frac{\varepsilon_0 c^2}{2}\int_{\text{all space}} \mathbf{B}^{*2}\,\mathrm{d}v,$$

where $\boldsymbol{D}$ and $\boldsymbol{B}^*$ are the electric induction vector and induced magnetic field vector respectively, and $\mathrm{d}v$ is the infinitesimal volume element in free space.

Using $\boldsymbol{B}^* = (\boldsymbol{u}\times\boldsymbol{E})/c^2$, we have $P = 2T/u$.

Now we have from classical electrodynamics[4],

$$T = Q^2u^2/(12\pi\varepsilon_0 c^2 k\,\delta R),$$

where δR is the radius of the point charge.

Therefore, in vector notation we have for the steadily moving point charge,

$$\boldsymbol{P} = Q^2\boldsymbol{u}/(6\pi\varepsilon_0 c^2 k\,\delta R). \tag{3}$$

The electromagnetic force acting on a point charge moving steadily in free space in a direction perpendicular to the direction of the uniform electric field operating in free space is given by:

$$F_\perp = (|P|/|u|)a_\perp = (m_0/k)a_\perp$$

$$= \gamma m_0 a_\perp = ma_\perp, \tag{4}$$

where $Q^2/(6\pi\varepsilon_0 c^2\delta R) = m_0$ and $\gamma = 1/k$. $a_\perp$ is the acceleration of the point charge in the direction perpendicular to u. This implies that from the consideration of classical electrodynamics, the transverse electromagnetic mass of charges varies with velocity.

Now using the above four equations, we shall prove the velocity-dependence of frequency and period of oscillations of an electric dipole, classically.

Let an electric force $\boldsymbol{F}_0$ (originating from a small charge inside the dipole) drive a point charge back and forth in a radiating dipole stationary on the surface of the earth. Then from classical electrodynamics,

$$\boldsymbol{F}_0 = -m_0\omega_0^2\boldsymbol{S}, \tag{5}$$

when the velocity of oscillation is small (m_0 is the electromagnetic mass of the charge in the stationary dipole, ω_0 the radian frequency of oscillation of the charge, and $\boldsymbol{S}$ the separating distance of the dipole).

Now, if the above dipole and the source of the field which excites the dipole are moving together with a velocity u on the earth in any direction perpendicular to its direction of oscillation, the electric force and the magnetic force acting on the point charge will be respectively, from eqs (1) and (2), (when $\theta = 90°$), $\gamma\boldsymbol{F}_0$ and $-(u^2/c^2)\gamma\boldsymbol{F}_0$. Therefore, the total electromagnetic force acting on the moving point charge is

$$\boldsymbol{F} = \gamma\boldsymbol{F}_0 - (u^2/c^2)\gamma\boldsymbol{F}_0 = \boldsymbol{F}_0 k, \tag{6}$$

and eq. (5) is modified to,

$$\boldsymbol{F} = -m\omega^2\boldsymbol{S}, \tag{7}$$

where $m(m_0/k = m)$ is the electromagnetic mass, ω the frequency of oscillation, and $\boldsymbol{F}$ the electromagnetic force acting on the charge moving with a velocity u.

From eqs (4)–(7) for the dipole moving with an uniform velocity on the earth in any direction perpendicular to its direction of oscillation we have,

$$\omega = \omega_0 k. \tag{8}$$

This explains transverse Doppler effect from classical physics.

The relation for the stationary dipole is

$$t_0 = 2\pi/\omega_0, \tag{9}$$

where t_0 is the period of oscillation and ω_0 the radian frequency modified for the moving dipole to

$$t = 2\pi/\omega, \tag{10}$$

Comparing eqs (9) and (10) with the eq. (8) we have,

$$t = \gamma t_0. \tag{11}$$

Equations (8) and (11) show that the frequency of oscillation of the moving radiating dipole decreases and that the period of oscillation of a moving electric dipole increases with its velocity on earth.

This at once destroys the 'here is one time', 'there is another time' concept, as well as the twin paradox of relativity.

In this classical approach, there will be no transverse Doppler effect when the radiating dipole is at rest on earth, while the observer with his measuring apparatus moves transversely to the dipole in the opposite direction.

In the light of this discussion, empirically unsupported analysis as in Grøn[2] is meaningless.

1. Unnikrishnan, C. S., *Curr. Sci.*, 2005, **89**, 2009–2015.
2. Grøn, O. G., *Curr. Sci.*, 2007, **92**, 416–418.
3. Heaviside, O., *Philos. Mag.*, 1888, **27**, 332.
4. Searle, G. F. C., *Philos. Mag.*, 1897, **44**, 340.

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Response:

The reason I did not write a comment on Grøn's[1] remarks earlier was the obvious inconsistency and lack of logical integrity evident in his remarks as reflected in the final paragraph, which asserted that most existing analyses of twin paradox are indeed correct. As pointed out in my

article[2], the available resolutions bank on very different physical reasons and calculations to arrive at a resolution. The difference in the time measured by two clocks cannot be due to multiple physical reasons if the entire time difference is attributed to each of these reasons, as in different resolutions! Also, Einstein himself in his paper regarded all special relativistic resolutions as incorrect, and offered his resolution based on the equivalence principle and general relativity. Grøn's enthusiastic but naïve assertion that Einstein's as well as special relativistic resolutions are correct defied logical integrity and consistency, and I thought that it was pointless to repeat my arguments.

However, it might be worth discussing one aspect. I had pointed out a new situation in twin-clock comparison that proved beyond doubt that acceleration at any point of the trajectory could not be the reason for the relative time difference. This involved freezing the reading of one or both clocks during any brief period of acceleration. In my analysis it should have been obvious for anybody who thinks about the situation that this freezing could be done locally by the observer who decides his accelerations, without being prompted by signals sent by the other observer. This important but simple point has been misunderstood completely by Grøn, and he goes into a long-winded and irrelevant calculation. The fact that accelerations cannot affect a stopped watch is obvious. If the period of acceleration is very short relative to the entire duration of the trip, then the time difference between the two observers must have been accumulated in the trip, but no part of it could be due to the acceleration. I brought in the point of both clocks being stopped just to block the usual illogical arguments that one sees in standard resolutions, where one attributes the time difference to some perceived change in the stationary observer's clock when the other observer changes his state of motion. However, this is clearly not needed, and one can consider the observer B freezing his clock-reading during any period of acceleration, without any signal prompt from A, and the results will essentially be the same (with small corrections proportional to 'stoppage time'). Hence it is clear that Einstein's resolution that used acceleration and the apparent gravitational field through the equivalence principle is incorrect. Since Einstein himself discredited all other resolutions as unsatisfactory in his paper, I do not want to stress that again. The correct resolution is that the time dilation is caused by motion through the matter-filled universe, and this has nothing to do with accelerations and non-inertial motion. The effect is gravitational, due to real matter in the universe, and not due to the acceleration and brief apparent gravitational fields, as Einstein thought. In fact, gravitational 'field' is irrelevant for the problem, and what matters is the difference in potentials experienced by the clocks, which depends on the velocity of the clock with respect to the preferred cosmic frame. Finally, my challenge to defenders of special relativistic resolutions and Einstein's resolution on this matter (the two are contradictory, as Einstein himself noted) is to rigorously disprove my assertion that the effect is due to cosmic gravity and not due to acceleration, etc. perhaps by a counter example!

1. Grøn, O. G., *Curr. Sci.*, 2007, **92**, 416–418.
2. Unnikrishnan, C. S., *Curr. Sci.*, 2005, **89**, 2009–2015.

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A 'copy and paste' review article published in *Current Science*

I read with interest the article 'Plagiarism, a scourge' by K. R. Rao (*Curr. Sci.*, 2008, **94**, 581–586), in which he has explained the fraudulent means adopted by authors for publishing the papers. It is surprising to know that about 80 such articles were submitted in last three years to *Current Science* alone. One such article came to me for review two years ago, and I brought it to the notice of the editorial staff with all relevant details.

It appears that even after such careful scrutiny by the editorial staff, some manuscripts get accepted and published. One such review article was published in a recent issue of *Current Science*, 'Biosurfactants: Properties, commercial production and application' by Muthusamy *et al.* (*Curr. Sci.*, 2008, **94**, 736–747). Almost 70% of the review was 'copy and paste' with minor modifications from the following reviews published earlier: (1) Nischke *et al.*, Biosurfactants in food industry. *Trends Food Sci. Technol.*, 2007, **18**, 252–259. (2) Mukherjee *et al.*, Towards commercial production of microbial surfactants. *Trends Biotechnol.*, 2006, **24**, 509–515.

My intention is not to accuse but to hope that highlighting such practices will minimize them in future.

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Editors' Note

A significant proportion of the article, 'Biosurfactants: Properties, commercial production and application' by K. Muthusamy, S. Gopalakrishnan, T. K. Ravi and P. Sivachidambaram (*Curr. Sci.*, 2008, **94**, 736–747), has been reproduced from the article 'Towards commercial production of microbial surfactants' by S. Mukherjee *et al.*, in *Trends Biotechnol.*, 2006, **24**, 509–515.

The *Current Science* article is withdrawn.