Based on Feynman "A travelling field", on the electromagnetic radiation necessary and sufficient conditions

In the Feynman Lectures on Physics Volume 18, section 4, to study the electromagnetic radiation field produced an ideal experiment, Feynman called the "A travelling field".

18-4 A travelling field

Now for the new consequences. They come from putting together all of Maxwell's equations. First, let's see what would happen in a circumstance which we pick to be particularly simple. By assuming that all the quantities vary only in one coordinate, we will have a one-dimensional problem. The situation is shown in Fig. 18-3. We have a sheet of charge located on the yz-plane. The sheet is first at rest, then instantaneously given a velocity u in the y-direction, and kept moving with this constant velocity. You might worry about having such an "infinite"
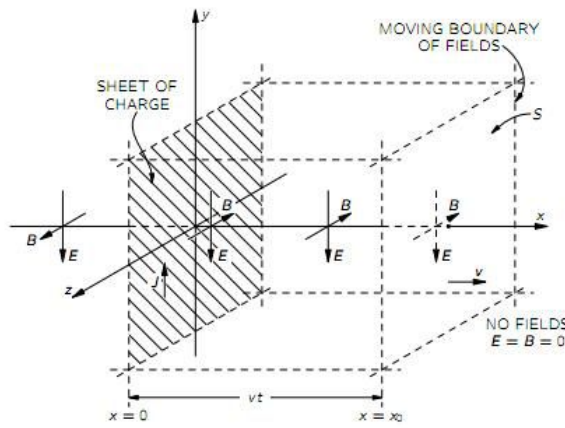

Fig. 18-3. An infinite sheet of charge is suddenly set into motion parallel to itself. There are magnetic and electric fields that propagate out from the sheet at a constant speed.

18-5

In Feynman discussed based on, further in-depth study of discussing the ideal experiment the electromagnetic wave radiation field formation conditions, can once again very clearly that: accelerating charge is generated electromagnetic wave radiation field is necessary but not sufficient condition; the source charge doing work on electromagnetic field is sufficient and necessary conditions for generating electromagnetic radiation field.
Feynman original discussion, can exist independently from the source charge "A travelling field", highlights are as follows:

1. The initial moment T0, in the vicinity of the YZ plane through the origin, there are two mutually approaching "infinite" surface charge sheet uniformly charged stationary, two surface charge sheet brought opposite polarity charge, charge density equal; and each space electromagnetic field strength at zero;
2. Thereafter, the process after a short time, until the moment T1, the positively charged surface of the charge sheet, (by external forces) along the Y-axis acceleration reaches a positive V; and, after a certain time to a moment T, surface charge sheet steady speed of V; then, as shown in the X coordinate value is less than CT spatial range, uniform magnetic field induced B (direction is positive, negative Z), induced uniform

electric field E (negative direction Y);

3. Later, to a moment T2, superimposed another pair exactly like surface charge sheet, however, in which the surface charge sheet with a positive charge, do (-V) motion; then after a moment of T2, to a moment T', in the X coordinate value is less than C (T'-T2) of the spatial extent of the electromagnetic field strength will be restored to zero (no longer continue to produce electromagnetic radiation field); however, the absolute value of {X coordinate greater than C (T'-T2) within less than C (T'-T1)} spatial extent, there may be one independent of the source charge "A travelling field" (A travelling electromagnetic radiation field).

In recognition of Feynman theoretical perspectives, on the basis of the above, we can see: the entire (T1, T2) during the movement velocity V (surface charge sheet), continues to "the travelling field" supplement the radiant energy if the push force movement of the surface charge sheet referred to as F, obviously, the supplementary power:

F·V=-∫ρV·Edσ (dσ for surface element, ρ for surface charge density)

Exclude electromagnetic radiation field starting build, and ending two corresponding short period of time, the entire (T1, T2) period, no charges accelerated motion, there is a charge for the electric field urging continued doing work, continuous supply of electromagnetic radiant energy!

Visible, and electromagnetic radiation field is always accompanied by: F·V = 0; this is the necessary and sufficient conditions for formation of electromagnetic radiation field.

On the basis of discussions on the existing Feynman, and then continue further and can more clearly prove: even if there is a charge made to accelerate the movement, it may not produce electromagnetic radiation field.

Prove as follows:

①. When the surface charge sheet another positively charged, when (-V) movement, acting on the two reverse movement of the surface charge sheet induced electric field force to zero;

②. If the external force is not removed, surface charge sheet the two reverse movements are bound to happen equal and opposite direction of accelerated motion;

③. According to the superposition principle, even if the two surface charge sheets produce the same as the "equal size, the opposite direction of the acceleration movement", it is also certain that no longer continue to radiate electromagnetic energy;

④. Therefore, the charge acceleration motion is a necessary but not sufficient condition for the formation of the "A travelling field" (the electromagnetic wave radiation field).

QED.

The conclusions are as follows:

Charge accelerating is the formation of "A travelling electromagnetic radiation field" necessary but not sufficient condition; Charge urged electric field doing work --F • V ≠ 0, is sufficient and necessary conditions for the formation of the electromagnetic radiation field.

Further research and thinking:

In three steps Feynman discussed above, after which the first two steps to remove the external force F, will happen then?

The first possibility is - surface charge sheet movement in the opposite direction of movement of the self-inductance of its electrical field strength E of action, slow down to a lower speed value u, and then maintain the speed constant, and stop the external electromagnetic radiation field to add energy;

The second possibility is - surface charge sheet movement in the opposite direction of movement of the self-inductance of its electrical field strength E of action, slow down to a lower average speed value u, and around the average speed u, generating sustained and stable rate fluctuations (Energy between the "Charge mechanical energy" and charge a small neighborhood-wide "electromagnetic energy" conversion, conservation)- The average velocity u and charge motion corresponding fluctuations, it is likely, that the physical mechanism of de Broglie wave!