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Checking Time-Dependent Disorders in Homogeneous and Stationary Plasma Magneto Resistance

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Abstract

Our aim in this article is the finding time-dependent disorders in homogeneous and stationary plasma magnetoresistance that it will be described by using the equations described in the text these equations are non-linear. However, we restrict our attention to Low-amplitude disturbances and so we expect that finding a set of linear differential equations that describe the Low-amplitude differences then the wave form of the equations will be searched, if the velocity is non-zero non-impaired, but uniform. Always, we can move plasma to a framework in which it is at stasis. Therefore, we assume that the initial velocity is zero and also assume that the plasma is in equilibrium. If the static balance by entering a slight disturbance in the plasma velocity, this disturbance leads this small magnetic field disturbance disorders, fluid pressure and mass density. We infer that if the system does not establish that the magnetic field or magnetic field intensity is low. So that it becomes possible to ignore its effect and when the gas temperature is uniform, wave properties of the system can be studied using analytical methods.

Keywords: Approximation Conductivity, Magneto Resistance Hydrodynamics, Plasma, Plasmoid Divergence, Sunspot, The Sheet Flow

1. Introduction

In electromagnetic laboratory tests, quantitative magnetic field is usually considered as "functional" or "determined" quantity and electrical current is considered as "created" quantity of the electric field. This expression is considered as common interpretation of Ohm's law[1]. But in Astrophysics and in many other situations of plasma physics, so it is reasonable that ohm's law is interpreted in slightly different form[2]. In other words, this expression means that we find approximation of infinite conductivity, Ohm's law leads to equation for the change in the magnetic field based on magnetic field and velocity field. In the absence of an internal magnetic field, disturbance will be unstable[3]. If an internal field is established, internal magnetic pressure will decrease with increasing radius, because the magnetic pressure is constant[4–9]. In this paper, we study the time-dependent disorders in homogeneous and stationary plasma magneto resistance. If the interior is severe enough, this reduction in internal magnetic pressure is higher than reducing the deviation of the external magnetic; in this case the disturbance is permanent.

2. Computational Method

Due to the plasma state descriptors and not due to the infinite conductivity, we consider consequences of Ohm's law with a little more detail[10]:

$$E = \eta j \frac{1}{c} V \times B \tag{1}$$

Where $\vec{V}$ is applied as the fluid velocity. And we obtain following equation for changing the magnetic field time[11]:

$$\frac{\partial B}{\partial t} = -\nabla \times (c\eta j) + \nabla \times (V \times B) \tag{2}$$

$$\frac{\partial B}{\partial t} = \nabla \times (V \times B) - \frac{c}{4\pi} \nabla \times (\eta \nabla \times B) \tag{3}$$

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This relationship can be rewritten again like the following. By determining the initial magnetic field distribution, velocity field, the resistance as a function of distance and time, this equation determines the change in the magnetic field. By using the fact that the magnetic field is no divergence, in turn, this equation can be written (in the vertical pages) as:

$$\frac{\partial B}{\partial t}=\nabla\times\left(V\times B\right)-\frac{c}{4\pi}\left(\eta\nabla\times B\right)+\frac{\sigma\eta}{4\pi}\nabla^2 B \tag{4}$$

Second statement from left hand shows effect of resistivity change on current caused by magnetic field. Now, for simplicity, we will assume that resistivity is uniform so that the statement will be deleted. Now, for reasons that will become clear, penetration coefficient D is defined as follows[12]:

$$D=\frac{\sigma\eta}{4\pi} \tag{5}$$

However, the magnetic field without any divergence is including:

$$\frac{\partial B}{\partial t}=\nabla\times\left(V\times B\right)+D\nabla^2 B \tag{6}$$

First statement of right hand is called convection. And it will be seen that it shows the orientation of the magnetic field lines to "inertia" in the fluid. Second sentence is called penetrative statement. It shows leakage magnetic field lines in conductive fluid. Each of these two contradictory effects depending on the length and time scales can be overcome. So, be familiar with the following dimensionless parameters called "magnetic Renault number" is helpful alike Renault number hydrodynamic.

$$R_M=\frac{L^{-1}uB}{DL^{-2}B} \tag{7}$$

So that

$$R_M=\frac{Lu}{D} \tag{8}$$

However, in this equation, we only refer to magnitude corresponding quantities. L is the length characterized by shift of the magnetic field. Obviously, domination of penetration or convention depends on whether $R_M \prec\prec 1$ or $R_M \succ\succ 1$. For laboratory tests, it is including liquids such as mercury or sodium, per Laboratory rates $R_M \prec\prec 1$.

However, in geophysics and astrophysics, the number R_M is too large. For the special case of hydrogen plasma quite ionized hydrogen plasma, terms of penetration coefficient can be utilized. In this case, the penetration rate is expressed as follows:

$$D=10^{13/1}T^{-3/2} \tag{9}$$

So that the number of magnetic Led Renault becomes:

$$R_M=10^{13/1}T^{-3/2}Lu \tag{10}$$

For example, consider the situation in the sphere magnet, common temperature is $T=10^4 K$. It can be typical lengths scale of the radius earth, so that $L\sim 10^9\,cm$.

If, for speed, the speed of the jet stream is about $10^4\,cms^{-1}$, we find that $R_M\sim 10^6$.

Another example, when the change time of magnetic field is an active area of the solar corona. In this situation $T\sim 10^6 K$ and $L\sim 10^9\,cm$, common movement lead to $u\sim 10^5\,cm\,c^{-1}$ and we find that this value $R_M\sim 10^{10}$ will be obtained[13–19]. We see that in both examples, Geophysical and Solar Physics, the effect of penetrating statement will be ignored, completely, if their length scales are related to macroscopic systems. However, we should be cautious in giving out these assumptions. For example, if we assume a situation where a pair of sunspot moved to another pair of sunspots, this fact that the plasma is strongly conductor prohibits the acceptance of a potential field configuration. Instead, there tends to be a region with a high gradient magnetic field, called "laminar flow".

3. Result and Discussion

Now, we assume that if there is Infinite conductivity, infinite conductivity, or its equivalent, the magnetic unlimited number Led Reno should be considered. In this case, you have:

$$\frac{\partial B}{\partial t}=\nabla\times\left(V\times B\right) \tag{11}$$

Suppose Γ Package parcel surrounded by S surface in a non-uniform magnetic field, and $\vec{B}(x,t)$ is variable in time. Our goal is to evaluate the rate of change of the flux through the surface by assumption that parcel with fluid, which is assumed to be perfectly conducting, is moving. In a short period of time Δt, our goal is to evaluate the rate of change of the flux through the surface. Each point on the closed curve Γ travels a little distance to $v\Delta t$ until it has become the new jump Γ'. Now every point on the surface S moves to another place and they are dislocated, and draws a new level of S', it is restricted jump Γ'. Thin annular surface connected Γ and Γ' jump, that it is shown by S_a. Now we want to compare the magnetic flux enclosed Γ jump in time T with the product flux jump Γ' at time $t+\Delta t$ then, we write:

$$\Phi\left(S,t\right)=\int_{s} d\ S\ n.B\left(x,t\right) \tag{12}$$

And,

$$\Phi\left(S',t+\Delta t\right)=\int_{s'} d\ S\ n.B(x,t+\Delta t) \tag{13}$$

Where n is the unit vector perpendicular on the surface. By expanding $B\left(x,t+\Delta t\right)$ it is clear that until the first time of Δt , we have:

$$\Phi\left(S',t+\Delta t\right)=\int_{s'} d\ S\ n.B(x,t)+\int_{s} d\ S\ n\frac{\partial B}{\partial t}\Delta t \tag{14}$$

Change is entered through the integral of the second term area S instead of S' area is the second-order so that it can be ignored. It is assumed that the S_a magnetic flux passes, we have the first-order Δt :

$$\Phi\left(S_a,t\right)=\oint_{\Gamma} \left(ds\times V\Delta t\right).B\left(x,t\right) \tag{15}$$

Since the magnetic field is no divergence, we have:

$$\Phi\left(S,t\right)=\Phi\left(t',t\right)+\Phi\left(S_a,t\right) \tag{16}$$

Now according to above equation, we have:

$$\Phi\left(S',t+\Delta t\right)-\Phi\left(S,t\right)= \tag{17}$$

$$\int_{s} d\ S\ n\frac{\partial B}{\partial t}\Delta t-\oint_{\Gamma} \left(ds\times V\Delta t\right).B(x,t)$$

In the $\Delta t \to 0$, we can write this equation as follows:

$$R_M=\frac{L^{-1}uB}{DL^{-2}B}$$

$$\frac{d\phi}{dt}=\int_{s} d\ S\ n\frac{\partial B}{\partial t}-\oint_{\Gamma} ds.\left(V\times B\right) \tag{18}$$

As it moves, the rate of change of the $d\Phi/d$ magnetic flux enclosed section is filled with fluid.

By using Stoke's theorem, it becomes:

$$\frac{d\phi}{dt}=\iint_{s} d\ S\ n.\left[\frac{\partial B}{\partial t}-\nabla\times\left(V\times B\right)\right]=0 \tag{19}$$

We have shown that the magnetic flux threading in each level to move with the fluid level, does not change. Although we cannot directly infer from this statement that the "magnetic field lines" of plasma are "inertia", but see, this interpretation is fully compatible.

Another approach to this problem is the expansion of the right relationship between the infinite conductivity (by using $\nabla.B=0$) becomes:

$$\frac{\partial B}{\partial t}=\left(B.\nabla\right)V-\left(V.\nabla\right)B-\left(D.V\right)B \tag{20}$$

This includes the following equation, Convective derivative of the magnetic field vector, leads to:

$$\frac{\partial B}{\partial t}=\left(B.\nabla\right)V-\left(\nabla.V\right)B \tag{21}$$

Because of the continuity equation we have,

$$\frac{d\rho}{dt}=-\left(\nabla.V\right)\rho \tag{22}$$

Observed that:

$$\frac{dB}{dt}=\left(B.\nabla\right)V+\frac{B}{\rho}\frac{d\rho}{dt} \tag{23}$$

This equation can be rewritten as follows:

$$\frac{d}{dt}\left[\frac{B}{\rho}\right]=\left[\frac{B}{\rho}\right].\nabla]V' \tag{24}$$

Now, we consider change time of the small vector δx that two adjacent points are connected to the fluid, as the year is moving with described velocity field. The starting point at position x at time t is displaced the position $x+V(x)\Delta t$ at time $t+\Delta t$. The starting point $x+\delta x$ at time t will displace the position $x+\delta x+V\left(x+\delta x\right)\Delta t$ at the Δt moment. Thus, we find that,

$$\frac{d}{dt}(\delta\, x)=(\delta\, x.\nabla)V \tag{25}$$

4. Conclusion

All of the above relations, we find that where $\rho^{-1}B$ and δx are satisfied the same differential equation (forever). In this way, if at the beginning $\delta\, x=\varepsilon\rho^{-1}B$, this relationship has been established. So, if two particles are located adjacent to the plasma at the beginning of a line, the result suggests that they are located on a line field.

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