Is Ferromagnetism a Co-magnetic Phenomenon?

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1 Introduction

According to the Reciprocal System, magnetism is the manifestation of two-dimensional scalar motion of the rotational vibration type with space displacement. Since the stationary three-dimensional spatial frame of reference is capable of representing not more than one dimension of a scalar motion, only one dimension of the motion of a magnetic charge, which is two (scalar)-dimensional, is observable while the scalar motion in the second dimension is unobservable.

In the phenomenon of the ferromagnetism the material exhibits large spontaneous magnetization in the absence of any externally applied magnetic field below a characteristic temperature called the Curie point. Relatively few elements are ferromagnetic. This is because "a magnetic charge, as a distinct entity, can exist only where an atom is so constituted that there is a portion of the atomic structure that can vibrate two-dimensionally independently of the main body of the atom."[1] This precludes many elements from being ferromagnetic.

Another important point that we need to note is that "Ferromagnetism is a phenomenon of the time region, and its natural zero point (the Curie temperature) is therefore a boundary between two dissimilar regions…"[2] The rotational vibration which is the magnetic charge is not a basic motion; it is a modification of a specific portion of the basic rotation of the atom. In a solid state the atomic motion is already in equilibrium in the time region. The magnetic charge, therefore, effectively crosses a regional boundary when the motion falls below the time region unit of space, which is a compound unit and is smaller than the natural unit of space by the inter-regional ratio, 156.444.[3]

2 Into the Time Region

The conventional theory tries to explain the spontaneous magnetization of ferromagnetism by the mutual magnetic interaction of the atomic dipoles. The initial attempts at this explanation ran into trouble when it was found that the strength of this interaction, which is needed to explain the observed high intensity of magnetization, had to be nearly 10^4 times that of the postulated dipole-dipole interaction. When all rational attempts to account for the origin of this high interaction strength have failed. Quantum mechanics was invoked to interpret it as a purely hypothetical "exchange interaction."

In the Reciprocal System, however, the explanation comes out naturally: it stems from the second power relation between the corresponding quantities of the inside and the outside regions. Explaining cohesion in solids Larson points out: "As we found in Chapter 12, Volume I, the equivalent of distance s in the time region is s^2, and the… force in this region therefore varies as the fourth power of the distance rather than the square."[4] The inter-atomic distance in solids is, on the average, of the order of the compound unit of space applicable to the time region, namely, the natural unit of space divided by the interregional ratio, 156.444. Therefore, the dipole-dipole interaction strength worked out on the

1 Larson, Dewey B., *Basic Properties of Matter*, ISUS, Inc., Utah, U.S.A, 1988, pp. 215-216.
2 *Ibid.*, p. 251.
3 *Ibid.*, p. 6.
4 *Ibid.*, pp. 7-8.

basis of the inverse fourth power law would turn out to be $(156.44)^2$ or nearly 2.5×10^4 times stronger than that calculated on the basis of the inverse square law. This is precisely what is needed to account for the observed state of affairs.

3 Co-Magnetism

In an earlier paper[5] we have shown that when the magnetic motion enters the time region, the apparent direction of the motion reverses, resulting in an attraction of like poles and a repulsion of unlike poles. The phenomenon has been referred to as *co-magnetism*. This is illustrated in Figure 1, which is reproduced from the above referred paper.

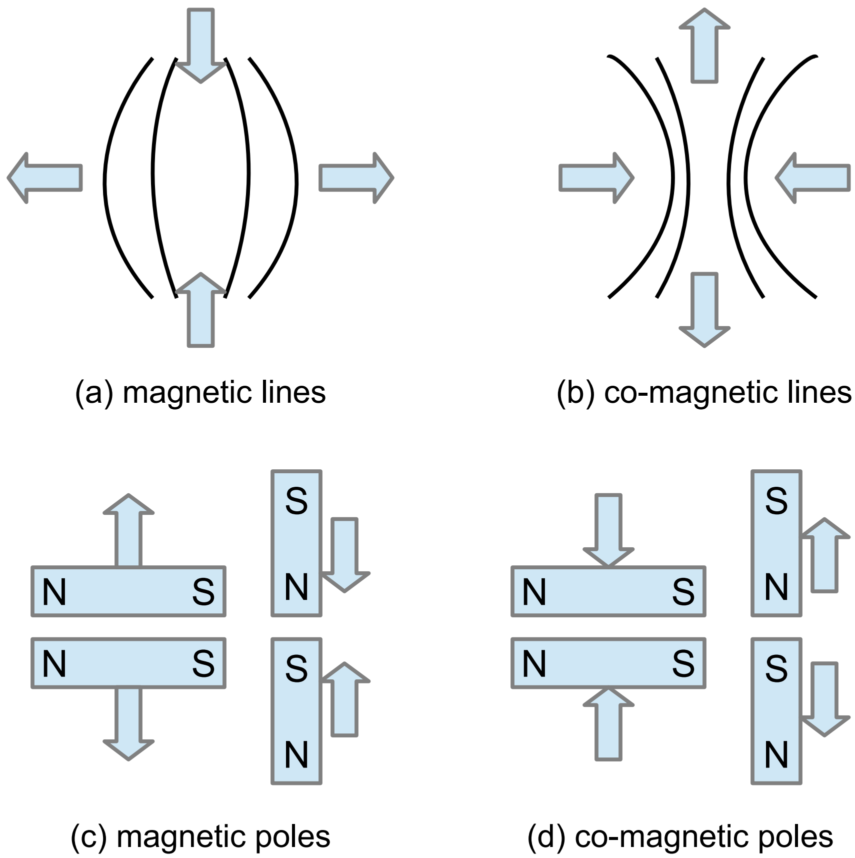

Figure 1: Magnetism versus Co-magnetism

It can be gathered from Figure 1(c) that the minimum energy configuration for two magnetic dipoles when located adjacent to each other is when the respective dipole directions are antiparallel, and if placed collinearly is when the dipole directions are parallel. On the other hand, in the case of co-magnetism, as could be seen from Figure 1(d), the minimum energy configuration of two dipoles which are adjacent is when their directions are parallel and if they are collinear when their directions are antiparallel. The scheme of orientations is illustrated in Figure 2.

5 K.V.K. Nehru, "Glimpses into the Structure of Sun: Part I, The Nature of Stellar Matter," *Reciprocity*, XVII(2), Autumn 1988, pp. 14-21.

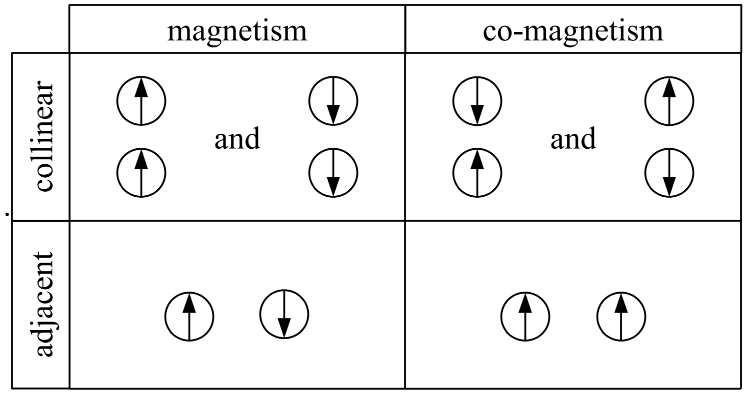

Figure 2: Dipole Orientations for Least Energy

We shall presently show how comagnetism is responsible for the domain structure characteristic of the ferromagnetic order. The point that is of significance here is that the magnetic charge (motion) is two dimensional. If p and q are respectively the effective speeds in the two scalar dimensions concerned of the magnetic charge, the motion of the charge crosses the regional boundary effectively when the product, $p \times q$, or more correctly, their geometric mean, falls below the value of the compound unit of space. This could happen in either of the three ways (see also the Appendix):

Case (i): when the component motion p, pertaining to the dimension parallel to the dimension of the conventional spatial reference frame, is still outside the compound unit, while the component q, pertaining to the second scalar dimension (which we shall refer to as the 'transverse dimension' for the purposes of this paper) crosses the regional boundary and enters the inside region;

Case (ii): when the component p crosses the regional boundary which the component q is still outside it; and

Case (iii): when both the components cross the boundary and enter the inside of the compound unit.

Though "the motion components in the second dimension are not capable of direct representation in the conventional spatial reference system,… they have indirect effects that are observable, particularly on the effective magnitudes."[6] Further, quoting Larson: "… a two dimensional (magnetic) charge consists of a rotational vibration in the dimension of the reference system and another in a second scalar dimension independent of the first, and therefore perpendicular to it in a geometrical representation."[7] Following our notation, we can conclude that the motion component q pertaining to the transverse (scalar) dimension, though not observable directly in the conventional reference frame, nonetheless, has indirect effects that do manifest in the geometric representations, in directions that are perpendicular to the dipole direction.

Coupling this conclusion with the inferences we have drawn earlier, concerning the least energy configurations of the magnetic and co-magnetic dipole pairs respectively, we can deduce the types of ordering that are possible in aggregates of these dipoles for the cases (i) to (iii) noted above. These are shown in Figure 3: (a), (b) and (c) respectively depict cases (i), (ii) and (iii).

6 Larson, Dewey B., *Basic Properties of Matter*, *op. cit.*, p. 212.
7 *Ibid.*, p. 213.

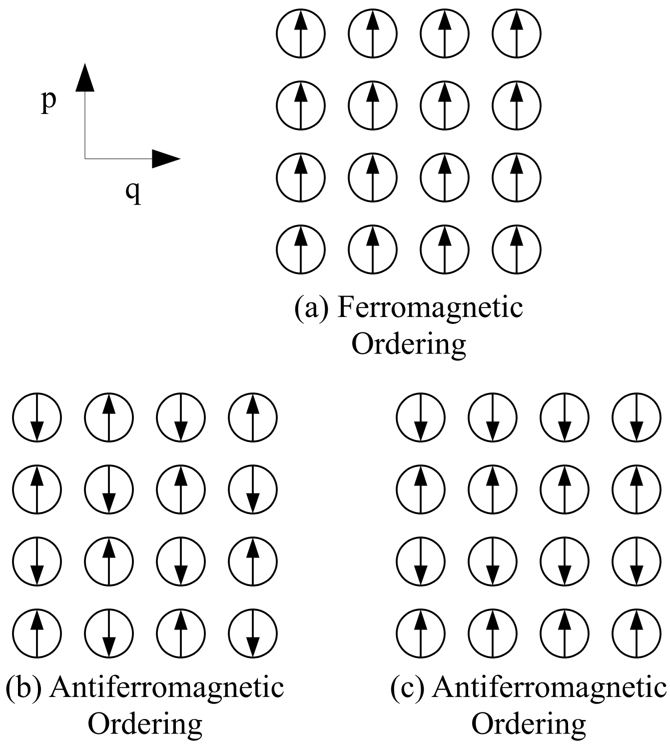

Figure 3: Magnetic / Co-magnetic Orderings

It is at once evident that case (i) results in the all-parallel dipole ordering called the ferromagnetic. The remaining cases can be seen to result in the antiferromagnetic orderings. In the case when the adjacent magnetic charges are of differing magnitudes antiferromagnetism shows up as ferrimagnetism.

4 Summary

(1) The ferro- and antiferromagnetic phenomena are the result of the magnetic charge entering the inside of the time region unit of space.

(2) The apparently strong interaction that is responsible for the spontaneous magnetization stems from the second power relations relevant to the inside region.

(3) The ferro- and antiferromagnetic orderings of the dipoles are the result of either one or both of the motion components of the two-dimensional motion that is the magnetic charge entering the inside region and thereby turning into co-magnetism in the dimension concerned.

5 Appendix

Theoretically there could be seven types of the dipole orderings. Let *p* be the component of the magnetic charge in the collinear direction, and *q* be the one in the traverse direction, of the geometric representations. Splitting *q* into *q1* and *q2* to represent each of the two transverse directions and adopting brackets to indicate that the component is inside the compound unit of space, we have the following seven possibilities, all of which exemplify the magnetic charge crossing the inter-regional boundary:

(i) p - [q1] - [q2]
(ii) [p] - ql - q2
(iii) [p] - [ql] - [q2]
(iv) p - [ql] - q2
(v) p - q1 - [q2]
(vi) [p] - [q1] - q2
(vii) [p] - ql – [q2]

Of these, combinations (iv) and (v) are geometrically identical. So are combinations (vi) and (vii). Only the first combination gives rise to ferromagnetism. All the remaining lead to antiferromagnetism. The characteristic common to all the antiferromagnetic combinations is the occurrence of parallel crystal planes such that while the dipoles in any plane are all mutually parallel, the dipoles in neighboring planes are antiparallel. The matter in which these combinations differ from each other is in the orientation of these planes and in the inclination of the dipole direction with respect to these planes.