In Search of a Geometrical Basis for the Ubiquitous Electromagnetic Energy

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Are photons a tetrahedral package of energy? Is current flow a geometrical dance of interconnected tetrahedral and octahedral forms? In the past, scientific investigations aimed at uncovering a geometrical basis of electromagnetic (EM) energy would not have been practical. Only over the past few decades have computational tools evolved to a level where it is possible to peruse the structure underlying the time-domain behavior of EM energy in detail. That is, our scientific capabilities are now at a level wherein we can ask deeper questions about the underlying nature of the EM energy. Consequently, I query: Wherein the electromagnetic form?

In this presentation I first describe the recently developed isotropic vector field decomposition methodology[1], and then report on an exciting application thereof. The isotropic vector field decomposition methodology purports to provide a heretofore unavailable perspective for computations involving vector fields, and also an opportunity to search for underlying geometrical forms of the EM energy[2, p.221]. The isotropic vector field decomposition methodology utilizes a computational grid (the isotropic vector matrix – IVM) wherein all vertices are equally spaced from their twelve nearest neighbors; discretizes a vector field upon the IVM in such a way as to preserve the isotropic nature of space; and contains an algorithm whereby the vector curl operator can be calculated. Figure 1 shows a vector equilibrium (VE) cell from which an IVM is built. (Also shown in Figure 1 are the six IVM basis vectors at the center of the VE cell, and the four hexagonal planes which compose the outer layer of the VE cell.) The vector curl algorithm utilizes field values on two of the four exterior hexagonal planes for each of the resulting six IVM basis vectors at the center of the VE cell. (That is, each unique pair of exterior planes of a VE cell begets one of the six IVM basis vectors at the center of that VE cell.)

The first application of the isotropic vector field decomposition methodology will be the construction of computational electromagnetic solvers. Investigations - utilizing visualization and data mining techniques on resulting time-domain data - will also be undertaken to uncover an underlying geometrical basis for EM energy. The hope is that eventually, when our grandchildren ask - “Wherein the electromagnetic form?” - we may have an answer.

Fig 1: The IVM basis vectors $e_1 - e_6$.

REFERENCES
