Use of Specially Conditioned EM Fields to Reduce Input Electromagnetic Energy Needs for Nuclear Fusion

H.D. Froning Jr.
PO Box 1211
Malibu CA 90262

Thomas F.Valone
Integrity Research Institute
Beltsville MD 20705

Terence W. Barrett has used gauge and group and topology theory to derive electromagnetic (EM) fields of higher SU(2) gauge symmetry than the relatively simple U(1) gauge symmetry of ordinary Maxwell EM fields. SU(2) electric (*E*) and magnetic (*B*) fields are described by tensors not vectors). Maxwell Equations for both U(1) and SU(2) EM fields include *E* and *B* field terms. But SU(2) Maxwell Equations include added tensor field terms that involve coupling of E and B tensor fields with tensor fields (A) that are determined by actions involving the scalar electric potential (φ) and magnetic vector potential (A).

Interestingly, “Weak Interactions” occurring in atomic nuclei are described by SU(2) fields that give rise to enormous attractive force. This enormous force, acting over very short distances, overwhelms strong U(1) EM repulsive force between two ions to cause their fusion. Here, ordinary EM fields described by U(1) symmetry Maxwell theory have angular momentum analogous to spin-1 particles which repel. By contrast, SU(2) matter fields inside nuclei and SU(2) EM fields created from U(1) EM fields have angular momentum analogous to spin-2 particles which attract.. So, as EM field action inside nuclear reactors draws fusion fuel ions closer together, mutual attraction of these ions might begin in the SU(2) EM field at much longer distances than the very short distances over which the ions are attracted by the SU(2) matter field of the Weak Interaction. Therefore, much less input energy might be needed for their fusion.

This possibility for reducing input electrical energy requirements for fusion is being explored for Inertial Electrostatic Confinement (IEC) fusion reactors which use a negatively charged “grid” to draw radial streams of fusion ions into close proximity in the reactor center. There, the strong, short-range attractive force of the SU(2) weak nuclear interaction overwhelms the U(1) electrostatic repulsion between the more closely-spaced ions, and their fusion occurs. Radial streams of ions are usually created in cylinders that are distributed radially around the reactor and contain nuclear fuel and a radio frequency (RF) antenna to deposit pulsed EM energy into the nuclear fuel and to induce a magnetic field by electric current flow in its windings. Nuclear fuel material is vaporized by RF electrical discharges and transformed into flowing plasma in each cylinder, and a strong coupling is established between the induced magnetic field and the resulting propagating cylindrical plasma wave. This paper describes a way to intensify such IEC fusion by transforming the plasma wave energy propagating from each RF antenna into ion-attracting SU(2) form.

Here, Barrett’s idea for transforming ordinary U(1) EM radiation into SU(2) EM radiation by modulating both phase and polarization of EM waves emitted from RF antennas is extended to EM plasma waves that are emitted from plasma-generating RF antennas in IEC reactors. If such polarization of plasma waves is achieved, significant spin-2 particle action and significant attraction of individual ions may occur in each SU(2) fusion ion stream, Thus, more focused ion beams will enter the IEC grid region – where: further ion focusing; even better ion mixing; and more intense fusion should occur. This would enable less input energy needed to achieve a given fusion gain for any fusion reaction – from dirtier, easier-to-achieve D-D and D-T reactions to cleaner and harder to achieve D-He3 and p-B11 ones. But, p-B11 reactions might benefit most, if SU(2) EM fields could lower the high p-B11 ignition temperatures (associated with high ignition energy requirements) to values less than those where intense bremsstrahlung radiation is emitted.