

## CHAPTER IV: RESULTS AND DISCUSSION

**i.** Considered here is the new bosonic mechanism for describing the obtaining of masses by bosons. This mechanism is constructed upon a model of spontaneous breaking of local symmetry (applies only in the context of the essence of the mechanism, Chapter I) and the hypothesis that the dark energy is represented as energy of a dark field in a single gravitational-dark field.

**ii.** The model describes massive gravitational and dark fields and their interaction with the vector field based on the Fierz-Pauli approach.

**iii.** Gauge bosons acquire masses <sup>note</sup> as a result of the interaction with a massive combined gravitational- dark field.

**iv.** Fermion masses are not considered.

**v.** Physical interpretation of terms proportional to  $B_i B_i^*$  (ref. description in Appendix A5, paragraph 4, eq. (2.6.1 b)).

The following is an explanation of the physical meaning of the terms of eq. (2.6.1 b):

a) in the ‘mixed’ state the representation (gravitational-dark field (A 2.1.1)- (A 2.1.2)) is reduced to case characterized by scalar mode. This corresponds to the Higgs model:

**f** gauge vector boson mass term is determined by  $-\frac{3}{8} B_i B_i^* C C^*$  (ref. eq. (2.6.1 b)), where  $C$  is

in the form of eq. (A 2.1.2);  $-\frac{3}{4} k^2 C^* C$  is the corresponding free-field term;

NB:

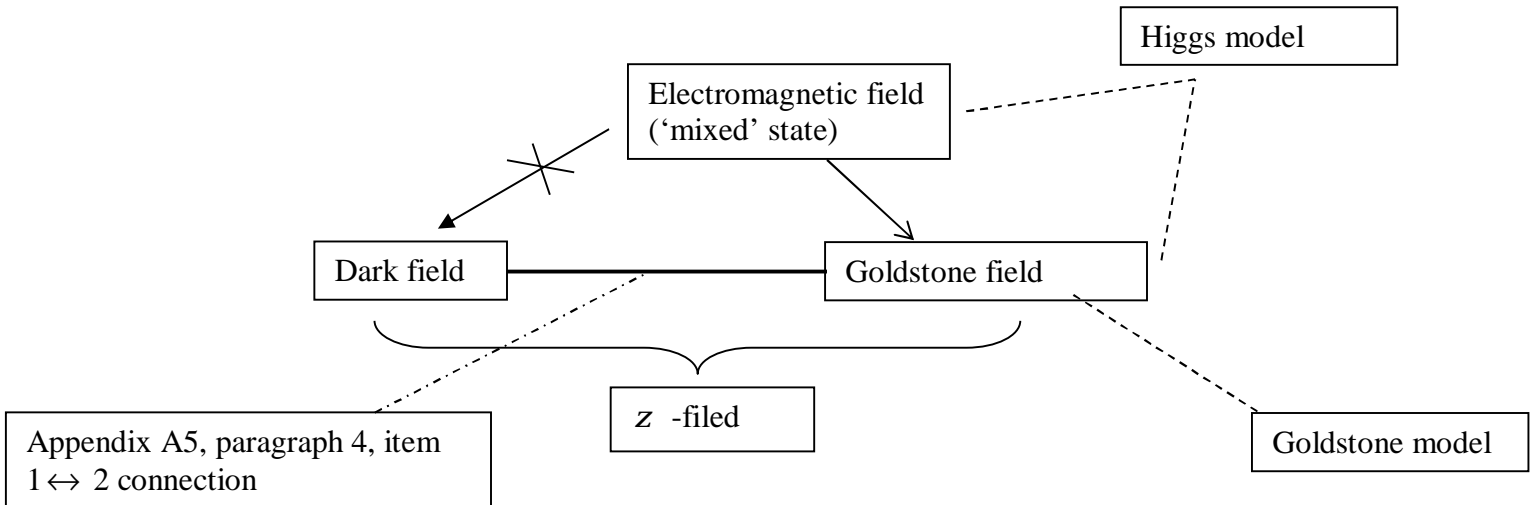


Fig. 1.1 Correspondence to Higgs mechanism (theory framework).

NB:

In the case v.a), the mass channel is driven by Goldstone boson (i.e., :  $CC^*$  term).  
 Obtaining mass by vector gauge boson is due to coupling between vector gauge boson and scalar mode and is described by schema (ref. Appendix A5, paragraph 4).

**p**  $B_l B_l^* A_{ik} A_{ik}^*$ ,  $k^2 A_{ik}^* A_{ik}$  terms are due to contribution of dark sector, which is not included into Goldstone-Higgs model and reduced to scalar mode. Scalar mode mass range is characterized by dark-axion value (ref. note 2, paragraph 1.1).

**p** electromagnetic (gauge) field is massless due to non- interaction with scalar mode.

b) in the ‘pure state’ the representation (gravitational-dark field (A 2.1.1)- (A 2.1.2)) is reduced to case characterized by tensor mode. This corresponds to ‘the new bosonic mechanism’ model:

**f** gauge vector boson mass term is determined by  $B_l B_l^* A_{ik} A_{ik}^*$  (ref. eq. (2.6.1 b)), where  $A_{ik}$  is in the form of eq. (A 2.1.0);  $k^2 A_{ik}^* A_{ik}$  is the corresponding free-field term;

NB:

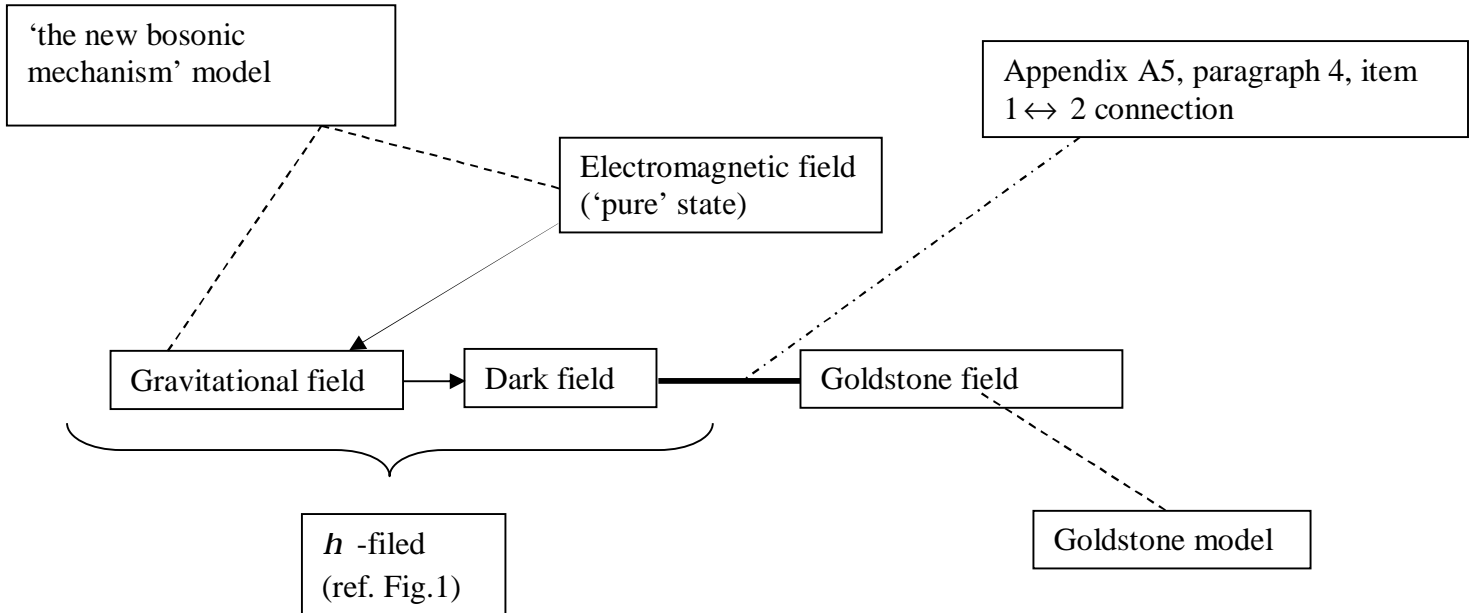


Fig. 1.2 Correspondence to ‘the new bosonic mechanism’ (theory framework).

NB:

In the case v.b) the mass channel is driven by gravitational field (i.e., :  $A_{ik}A_{ik}^*$  term).

Obtaining mass by vector gauge boson is due to coupling between vector gauge boson and tensor mode and is described by schema (ref. Appendix A5, paragraph 4).

**p** in this case gravitational instanton is the connection bundle, which by coupling with inverse metric tensor is reduced to tensor-gravitational scalar mode, which correspondently acquires dark - axion value (ref. Fig.14 below).

**p** electromagnetic (gauge) field is massive due to non minimal interaction with tensor mode (ref. Appendix A3, eq. (A 3.2)) , thus corresponding to the Ginzburg -Landau model<sup>note</sup> .

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*note:*

Ginzburg -Landau model relations (ref. Fig. 3):

**p** area a) is related to Higgs model;

**p** area b) represents the renormalization group flow from area a)  $\rightarrow$  area c); and is defined by the  $b$  - function (ref. Appendix A4, paragraph 3);

**p** area c) is related to sigma model on Calabi-Yau manifold. This model describes the low energy dynamics of complex 2-dim theories with monopoles (ref. Fig. 6, Mark 2, 4).