JUSTIFYING THE COMBINATORIAL HIERARCHY

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INTRODUCTION

- THE PROBLEM

- GENERAL COMMENTS

- THE CANONICAL DERIVATION

PHILOSOPHICAL REMARKS

- START WITH MINIMAL A PRIORI STRUCTURE
- TWO STRUCTURES AND THEIR INTERACTION
- EXAMPLES:
  - NO CONCEPT OF COLOR - BLACK AND WHITE OR SHADES OF GREY
  - EVENTS IN TERMS OF DEMONS
  - THEORY LADEN LANGUAGE

  THE KEY POINT IS THAT OBSERVED STRUCTURE MAY COME FROM EITHER THE DESCRIPTIVE LANGUAGE OR FROM ITS LIMITATIONS.

OVERVIEW

- A STRUCTURAL "SKELETON" FOR "REALITY"
- A STRUCTURE FOR THE PRACTICE OF PHYSICS
- THE INTERACTION BETWEEN THE TWO.

A POSSIBLE STRUCTURAL SKELETON FOR "REALITY"

- A PROCESS POINT OF VIEW
  - WON'T CREATE EVOLVING SYSTEMS FROM STATIC ONES
  - STRUCTURE IS GENERATED FROM PROCESS
  - THE CHARACTERISTIC NUMBERS ARE SIGNIFICANT
- A DISCRETE POINT-OF-VIEW
  - DEMANDED BY OBSERVED PROPERTIES OF THE UNIVERSE

A POSSIBLE STRUCTURAL SKELETON FOR "REALITY"

- THE PROCESS IS SELF-REPRODUCING
  - OTHERWISE A MORE FUNDAMENTAL "CAUSE" IS REQUIRED
  - LEADING TO AN INFINITE REGRESS
- IF UNIVERSAL, THEN MUST BE SELF REPRESENTING TOO!
- THE STRUCTURES & PROCESSES MUST CONVEY INFORMATION
  - HAS AN INFORMATION THEORETIC REPRESENTION
  - THEY MUST HAVE OBSERVABLE CONSEQUENCES

A POSSIBLE STRUCTURAL SKELETON FOR "REALITY"

- THE PROCESS ELEMENTS ARE BOTH OPERATORS AND OPERANDS
  - THERE IS ONLY ONE SET OF FUNDAMENTAL ELEMENTS
  - THE OBJECTS FORMED FROM FUNDAMENTAL ELEMENTS
  - THE SUBSETS CLOSED UNDER THE OPERATION OF DISCRIMINATION

A POSSIBLE STRUCTURAL SKELETON FOR "REALITY"

- IT MUST BE HIERARCHICAL IN STRUCTURE
  - DEMANDED BY "SCALE INVARIANT" CONSERVATION LAWS
  - COMMON OF SELF REPRODUCING STRUCTURES
- RAPIDLY GROWING COMPLEXITY PER LEVEL
  - DEMANDED BY THE COMPLEXITY OF THE WORLD
  - RICH AND NON-POLYNOMIAL
- THE COMPLEXITY IS COMBINATORIAL
  - IT IS NOT EXPONENTIAL

A POSSIBLE STRUCTURAL SKELETON FOR "REALITY"

- NON-TRIVIAL STRUCTURE IMPLIES DISCRIMINATION OVER Z_2
  - REQUIRES A PRINCIPLE OF DISTINGUISHABILITY OR EQUIVALENCE
  - FOR A BINARY SYSTEM WE CALL THAT DISCRIMINATION
- "APPROXIMATELY CONTINUOUS"
  - MATHEMATICAL CORRESPONDENCE PRINCIPLE:
  - THIS DEMANDS SOMETHING LIKE $2^n - 1$.

  THE NUMBER OF ELEMENTS N AT LEVEL I+1 IS GIVEN BY RECURSION FORMULA FOR THE COMBINATORIAL HIERARCHY:

$$n_{i+1} = 2^{n_i} + 1$$

A MINIMAL STRUCTURE FOR PHYSICS

- NON-SINGULAR OPERATORS ARE REQUIRED
  - THE "PHYSICAL" CHARACTER OF REPRESENTATION
  - DEMANDS NON-SINGULAR OPERATIONS
- A CAUSAL STRUCTURE MUST BE SUPPORTED
  - THE VECTOR SPACE
  - A COMPLETE AND ORTHOGONAL BASIS
  - HAS A REPRESENTATION AS SQUARE MATRICES
  - N*N OPERATORS PER LEVEL IS THEN THE ONLY ANSWER

A MINIMAL STRUCTURE FOR PHYSICS

- THIS STRUCTURE STARTS WITH
  - A TWO-DIMENSIONAL COMPLETE, ORTHOGONAL SPACE
  - THIS IS THE SIMPLEST SPACE WITH STRUCTURE
- SEPARABILITY OF HIERARCHICAL LEVELS IS REQUIRED
  - THERE MUST BE NO CONFUSION OF OBJECT TYPES
  - TOP-DOWN -- A PARTITIONING INTO MAXIMALLY DISJOINT SUBSPACES OF EQUAL DIMENSION
  - THE NEXT LEVEL WILL BE 4X4, THEN 16X16, ETC.
  - MEANS THAT THERE IS A UNIFORM NOTION OF LOCALITY
- THE NUMBER OF ELEMENTS AT EACH LEVEL IS GIVEN BY: $m_{i+1} = m_i^2$

INTERACTION BETWEEN STRUCTURES

- UNIQUE SELF-REPRESENTATION LIMITED TO FOUR LEVELS

  - THEREAFTER WE HAVE NO NOVELTY

    THE CHARACTERISTIC NUMBERS OF THE STRUCTURES SO GENERATED ARE APPROPRIATE FOR PHYSICAL INTERPRETATION

- A LONG LIST OF "INTRIGUING NUMEROLOGICAL RESULTS"