1. Phase Space Ensemble (PSE) Approach

The mathematical apparatus is borrowed from statistical physics. Points in extremely high dimensional spaces – phase spaces – refer to states of systems (or situations). The phase flow traces the physical development of these systems in time.

i) Properties and conditions correspond to phase space regions
ii) These regions are non-invariant (hence, non-self defining); they spread out under the action of the phase flow.
iii) Properties and conditions are perspectival constructions

2. Reductionism vs. Emergentism

(= reductive physicalism; all events driven by microphysical process at lowest level)

Shared Framework

ii) The world is physical

iii) There are levels and scales of physical operation

iv) At different levels/scales different sorts of properties interact

Do higher level properties emerge from lower level propreties? or are the higher level properties reducible to the lower level ones?

3. Supervenience

Family of properties A supervenes on family of properties B if any A-difference implies a B-difference. (If A and B are Boolean algebras with B complete, A supervenes on B iff A is a subalgebra of B.)

Mereological Supervenience: The macroworld is as it is because microworld is as it is.

(This allegedly supports microphysical reduction)

4. macro/micro	**coarse-grained/ fine-grained**
depends on size	depends on complete physical detail of the individual vs. aggregation of the individuals into the general
subject to additive mereological combination	subject to non-additive Boolean combination (as are properties)
is the axis along which upward and downward causation operates	cannot be in causal relation to one another

5. Physical Causation vs. Logical "Causation"

diachronic relationship between phase space regions (A causes B if most of A flows into B)	synchronic relation between phase space regions (A implies B if B contains A)
reduction supervenience and emergence tend to be synchronic hence causally trivial	underlies synchronic reduction, supervenience and emergence (emptying them of factual content).
part-to-whole and whole-to-part causation enter into distinct accounts; neither conflicts with nor trivializes the other	underlies upward and downward causation.

6. Causality and Mereology

In this example all synchronic relations are mereological, all diachronic relations, causal.

Whole: W_0 Parts: $P_1,\ldots,P_n$
in configuration C, which shifts to C′

E_{ij} = Effect of P_i at the beginning of period on P_j by end of period

E_{io} = the effect of P_i on W_0 (part-to-whole causation)

E_{oj} = the effect of W_0 on P_j (whole-to-part causation)

E_{00} = effect of W_0 on itself

mere and *comb* are mereological and causal combination, respectively.

$$E_{00} = mere_j(comb_i(E_{ij})) = comb_i(mere_j(E_{ij}))$$
$$= mere_j(E_{0j}) = comb_i(E_{i0})$$