

| SCIENCE THEMES | ASTRONOMY | PHYSICS | CHEMISTRY | GEOLOGY | BIOLOGY | COMP SCI | MATH/STA |
|----------------------------------|---|--|--|---|---|--|--|
| HIERARCHY OF SCALES OF SIZE | galaxies, stars, planets, moons, const., clusters | families of subatomic particles; atomic str. | elements, compounds, polymers, multimers | geologic time hier.; landsat to crystallog. hierarchy | organelles, cells, tiss. org.; org's; ecosystems | stepwise refinement; subprogram, sys. str.; | log scales; metrics; nested equations |
| MODELING REALITY: CAUSES & CHAOS | chaos in planet orbits | turbulence in flows; chaos in snowflakes & faucets | | chaos in weather sys. | chaos in muscle & heart-beats | how the comp. helps us "see" chaos | universal quantities in chaos |
| SYSTEM DYNAMICS & BOUNDS | gravity as action at a distance; | | | effects of asteroids on planets; greenhouse effects | membranes of cells; the skin eco-ranges; interactions | computer networking; | concepts of limits; fcn's as interaction |
| SELF-ORGZ ORIGINS & EMERGENCE | origins of the solar system; starbirth; cos. heterogeneity | | coacervates; hypercycles | volcanic isles; mech's of orogeny; | autocatalysis of organelles; new species; macroevol; | artificial life games; pattern recognition; | |
| REGULATORY MECH AND FEEDBACKS | stellar feedbacks; | nuclear fission rxns; | end-product inhibition; | Gaia & bio feedbacks to geo. | hormones; embryology; eco food web | program control statements; | computation explosion; |
| STABILITY & EQUILIBRIUM | Hertzsprung-Russell diag. stellar stabilities; | thermodynamic equilib; phys. stasis | balancing rxn equations; | | dynamic equilibrium MTS; homeostasis equilib. in ecosystems. | | math. of dynamic equilibrium; |
| CYCLES & OSCILLATIONS | galactic life cycle; stellar life cycle; oscillating cosmos | states of matter; | transitions, phase diagrams; | crustal re-cycling; biogeochemical; ice-age cycl.; | organism life cycles, species, eco sys life cycl. | recursion loops in prog; | math. of oscillations; |
| DUALITY, SYMMET. GROUP TH. | binary stars; matter vs. anti-matter; asymmetry; | opposite spins; wave-particle dual. | optical activity, + and - charges; ana-catabolic rxns. | dual forces in storms, crystal form symmetries; | complementarity in dna; gene info trans. bilateral sym. neuropeptides | duality in programming | group theor. duality in algebraic sets; geom. & Poincaré |
| LIMITS, CONSERV. ON FLOWS | universal constants; anthropic principles | physical limits; entropy laws; | chemical information | | biopolymers as info. | history of information theory; limits of computing | math of info theory; |
| INTERACT NETS & FIELD TH. | gravitational fields; | | types & basis of chemical reactions; | multiple effects of CFCs | ecosystem structure; dev'tal gradients; | | |
| FORM, PROPORTION & CHANGE | closed or open univ.? | engineering allometry; | | | biological allometry; neural nets; | | discovery of the calculus |
| MECH OF VARIETY AND EVOLUTION | | | chem competition & selection; | punctuated equilibrium; Burgess shale | discovery of evolution; | genetic computing algorithms; | how chance generates variety; |