

An Artist walks into
the Physics Dept...

Kim Bernard
&
Jacob Barandes



"It's fascinating that there are predictable patterns in matter and motion. I'm interested in creating work that demonstrates this phenomenon simply, with an aesthetic that allows the viewer easy access, and provides a tangible way of seeing physics."

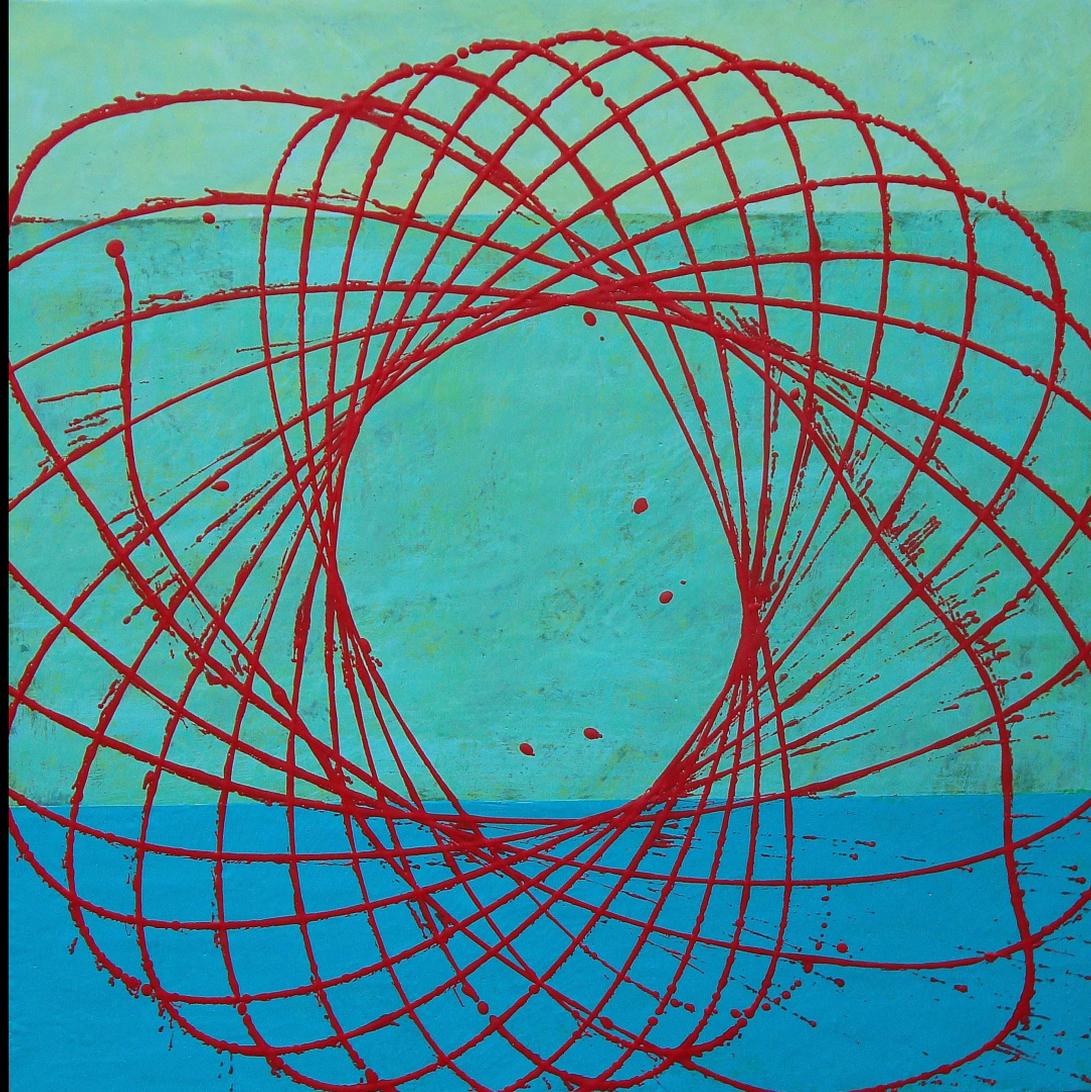
Kim Bernard

Making the Beauty of Physics Accessible

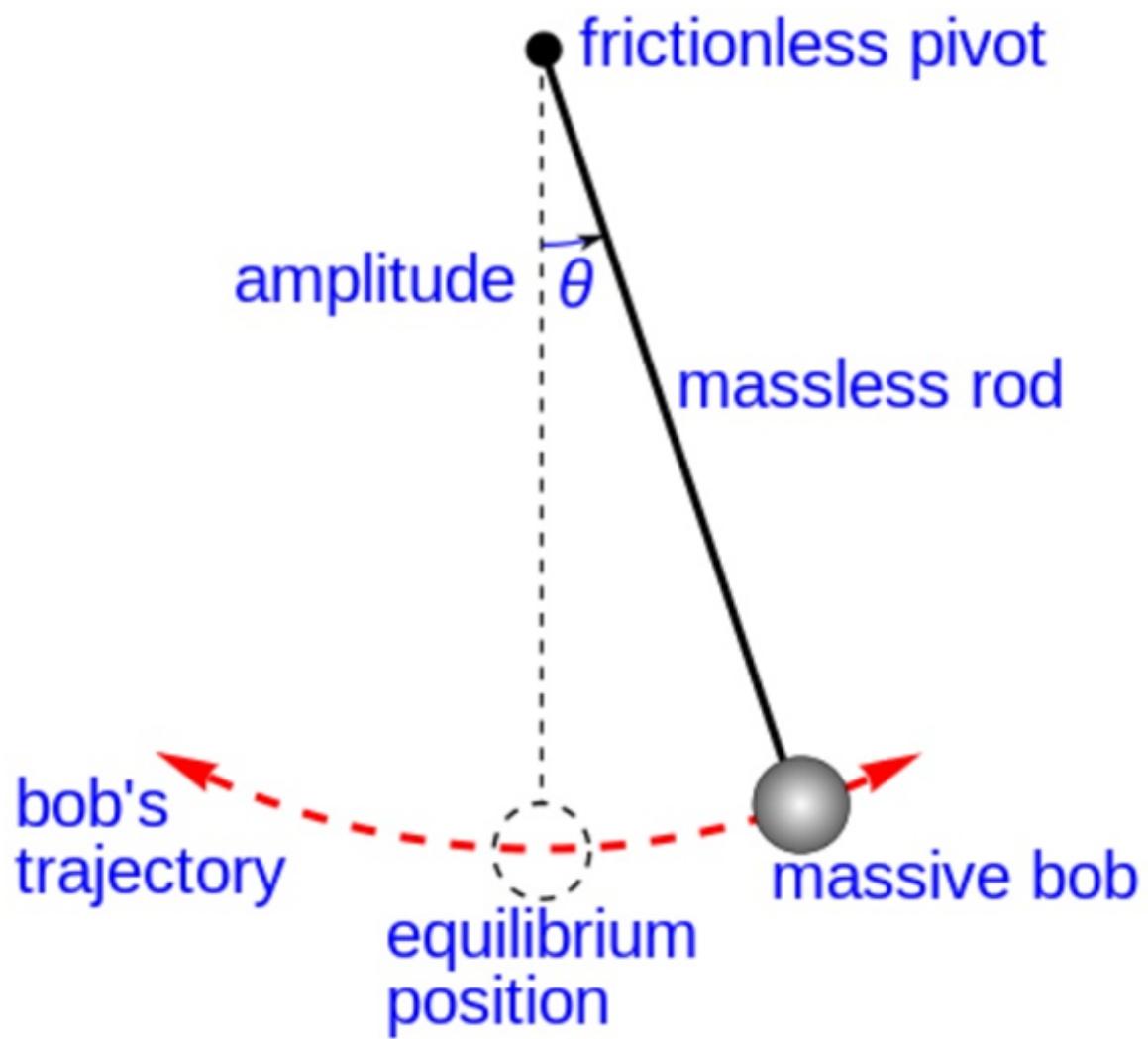
Art can be very beautiful

Physics can be very beautiful

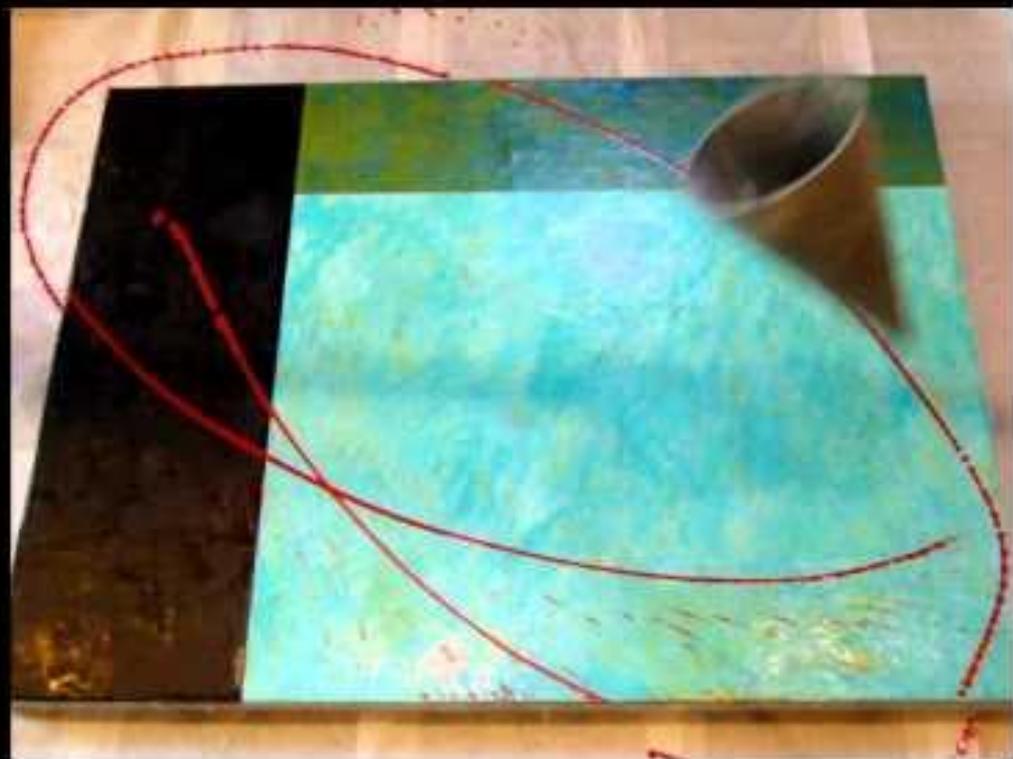
The beauty in physics becomes visible with training,
so newcomers and outsiders need help seeing it



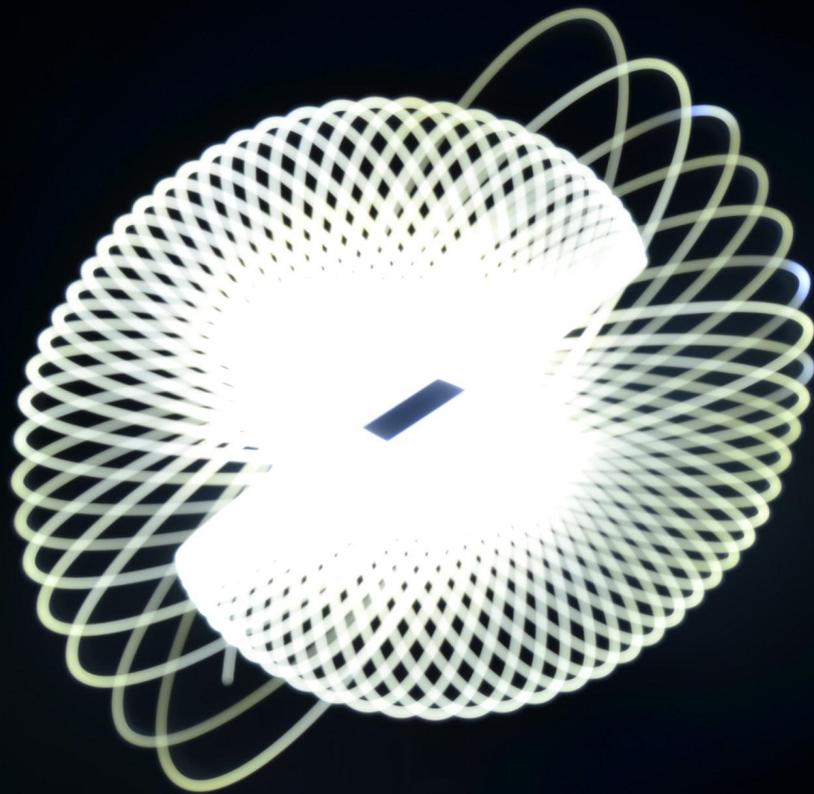
A **PENDULUM** is a weight suspended from a **PIVOT** so that it can swing freely. When a pendulum is displaced sideways from its resting **EQUILIBRIUM** position, it is subject to a **RESTORING FORCE** due to **GRAVITY** that will accelerate it back toward the equilibrium position. When released, the restoring force combined with the pendulum's mass causes it to **OSCILLATE** about the equilibrium position, swinging back and forth. The time for one complete cycle, a left swing and a right swing, is called the **PERIOD**. The period depends on the length of the pendulum, and also to a slight degree on the **AMPLITUDE**, the width of the pendulum's swing.

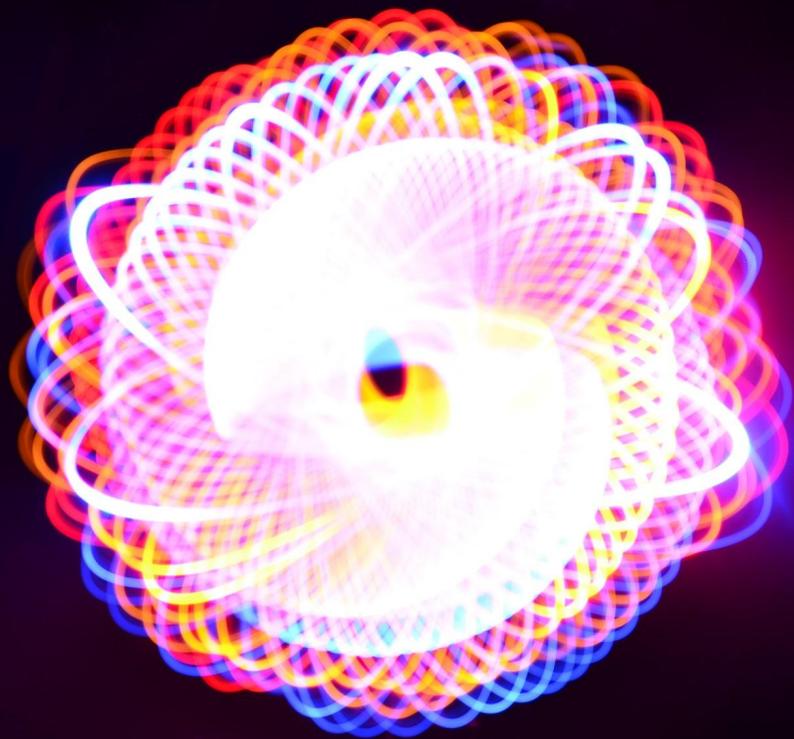




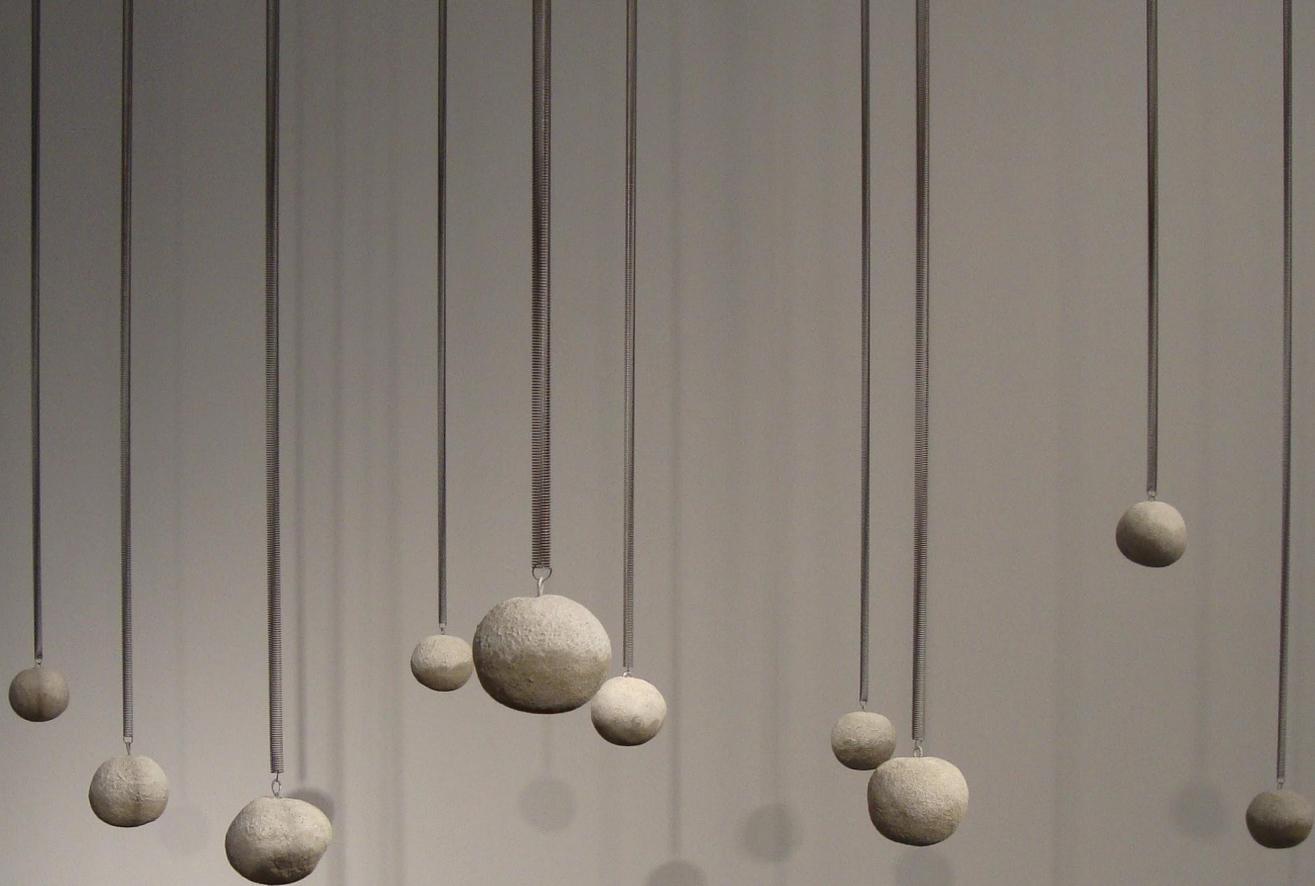






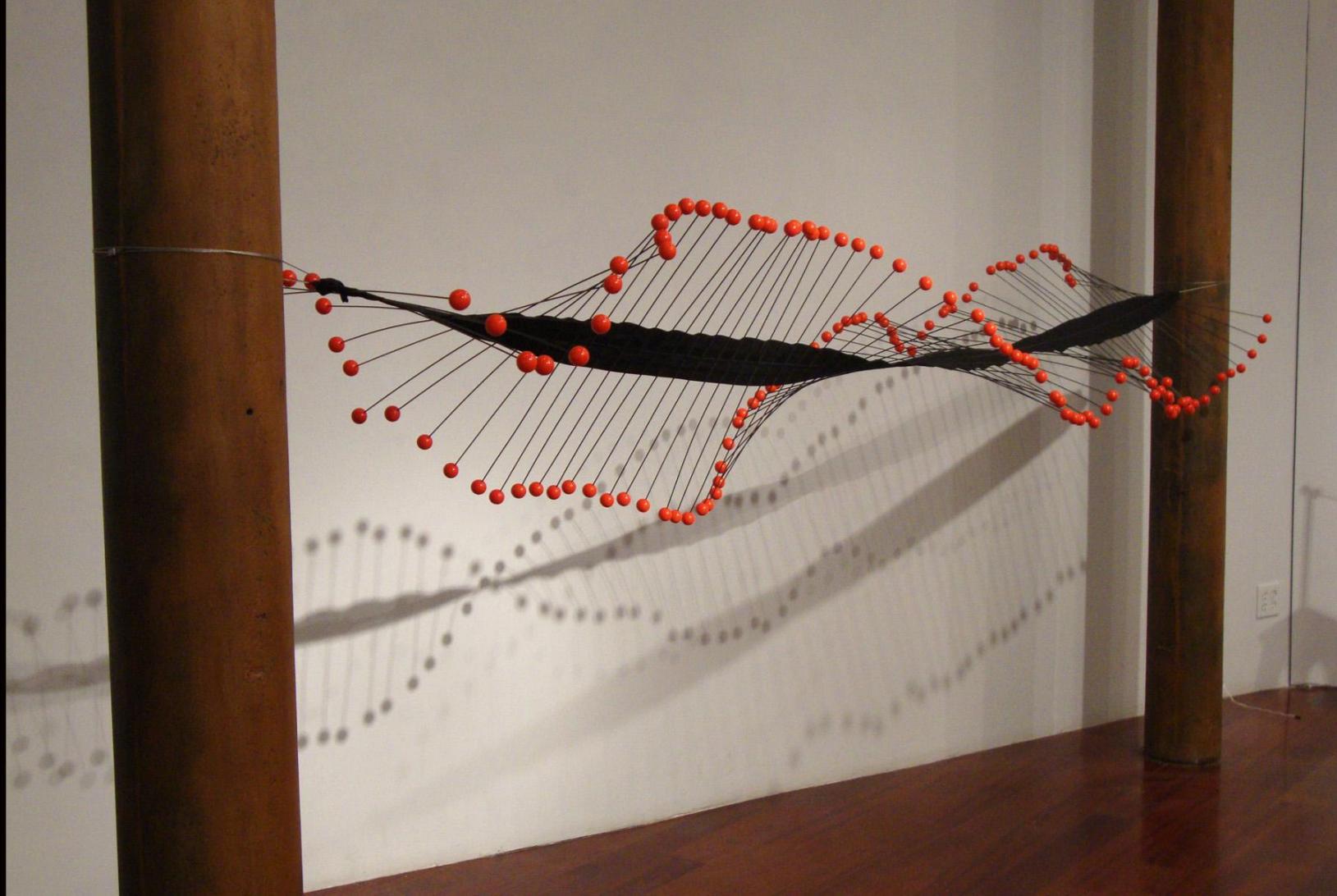


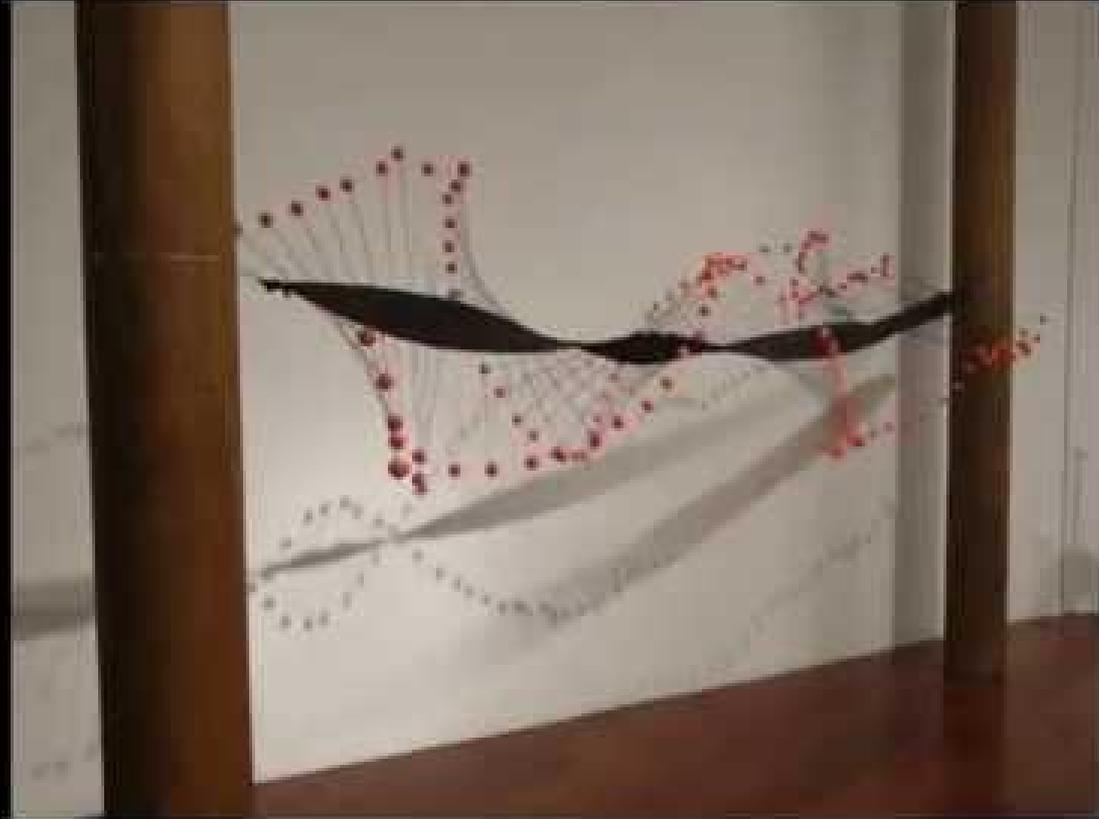


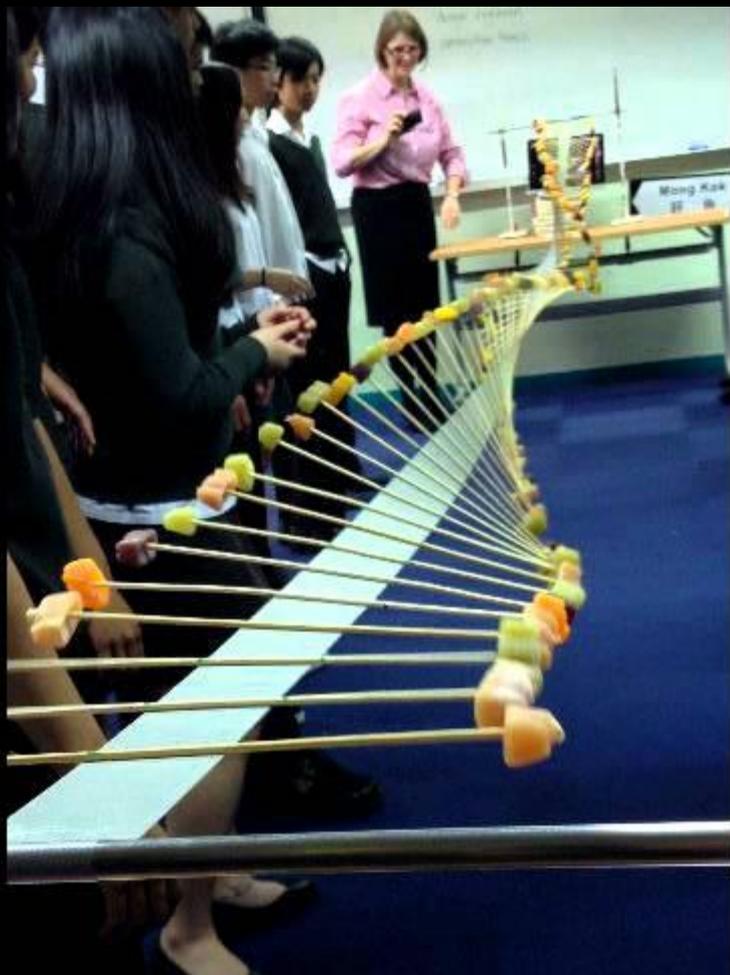












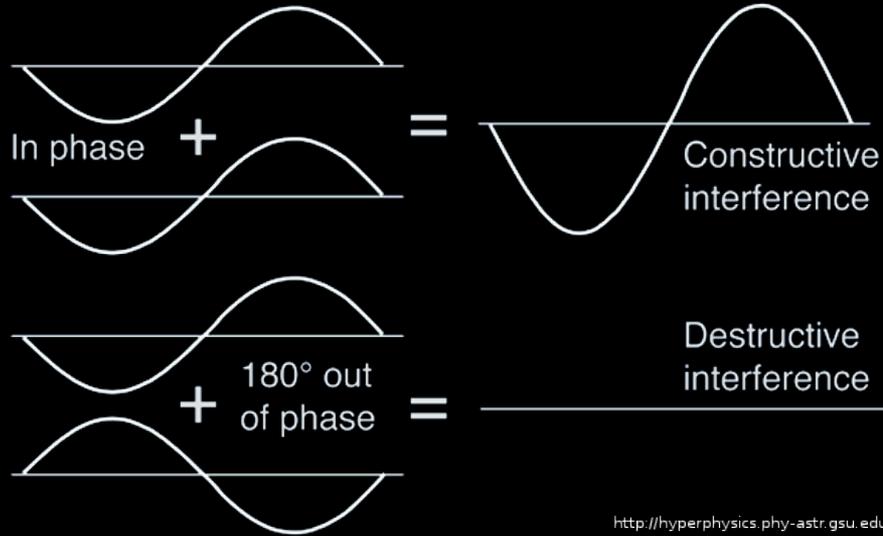




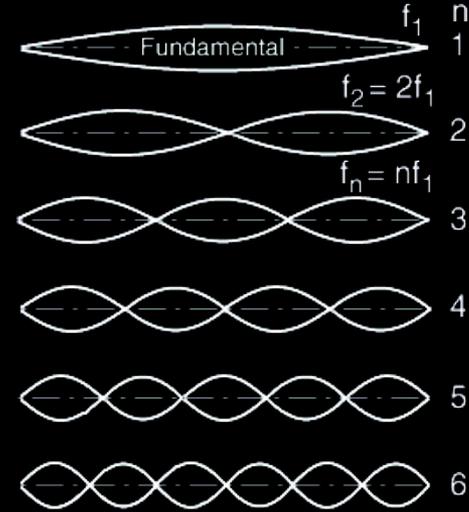




Interference and Standing Waves



<http://hyperphysics.phy-astr.gsu.edu>



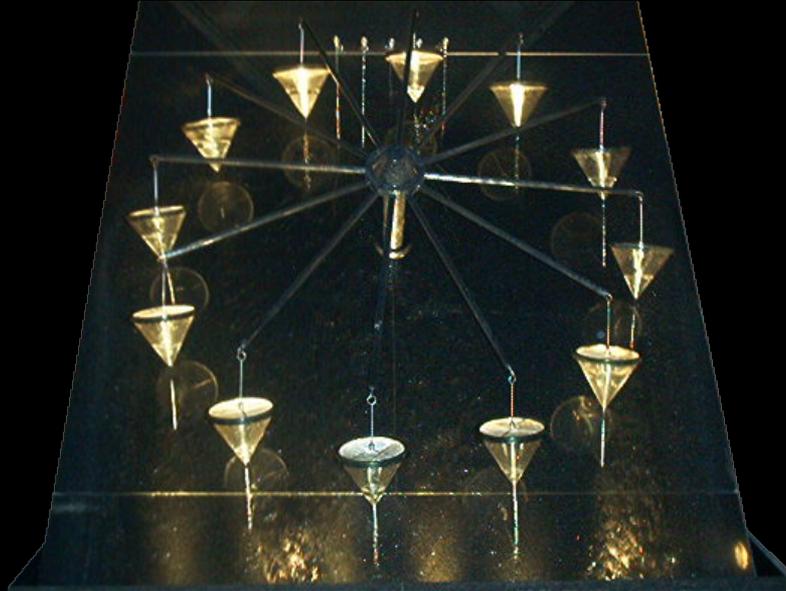
<http://hyperphysics.phy-astr.gsu.edu>

Traveling wave reflects at the end and then constructive interferes to produce a standing wave

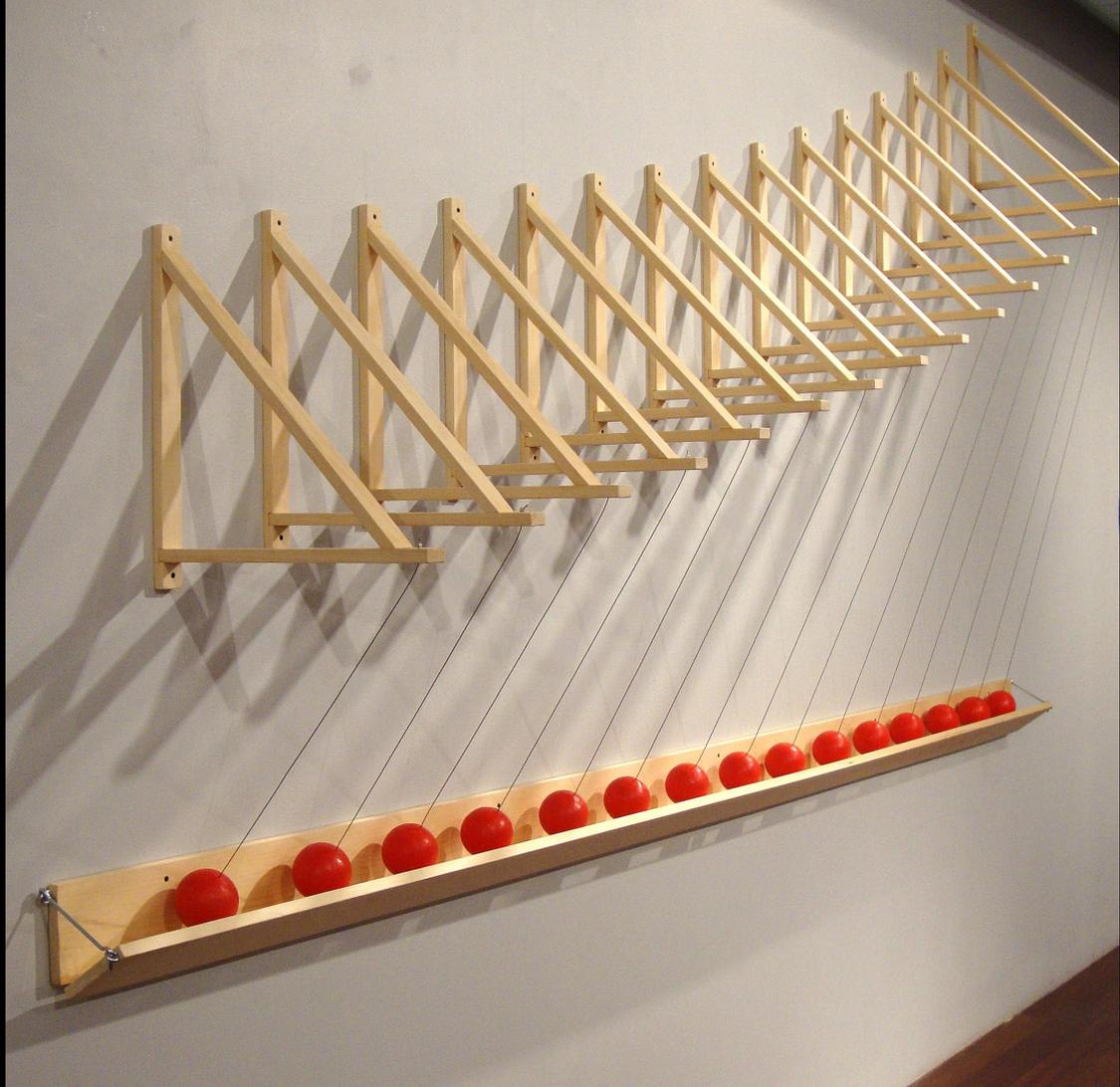




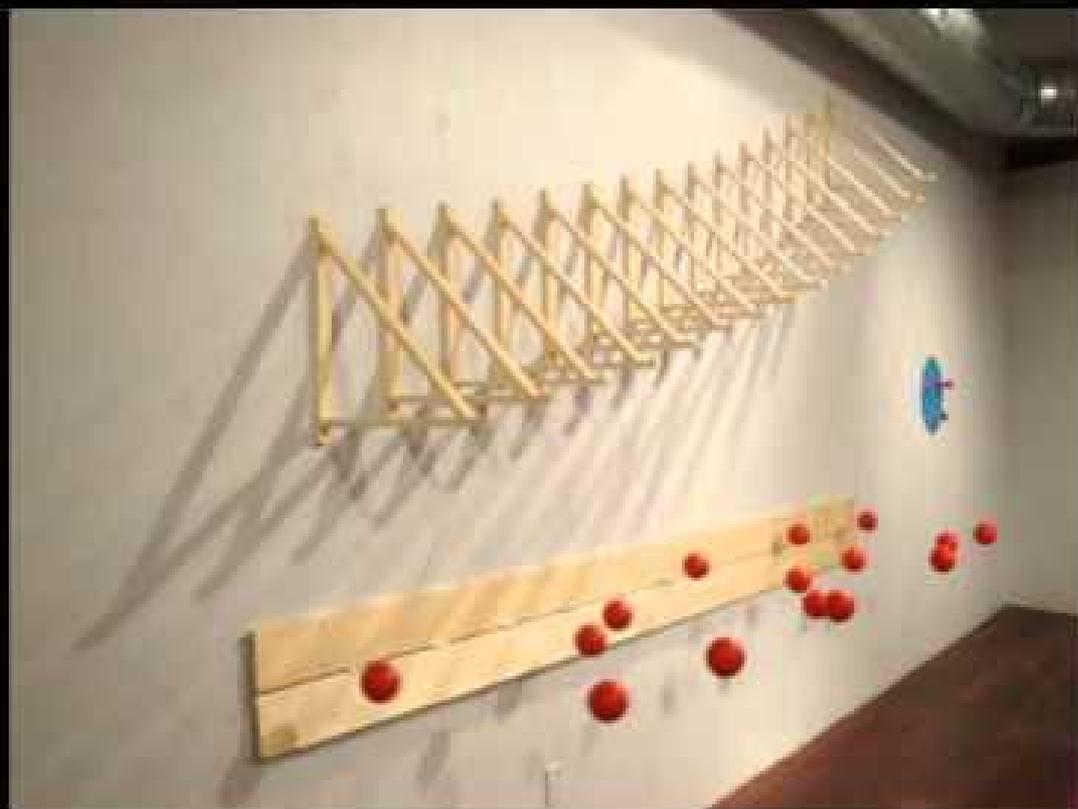
Turbulence Clock

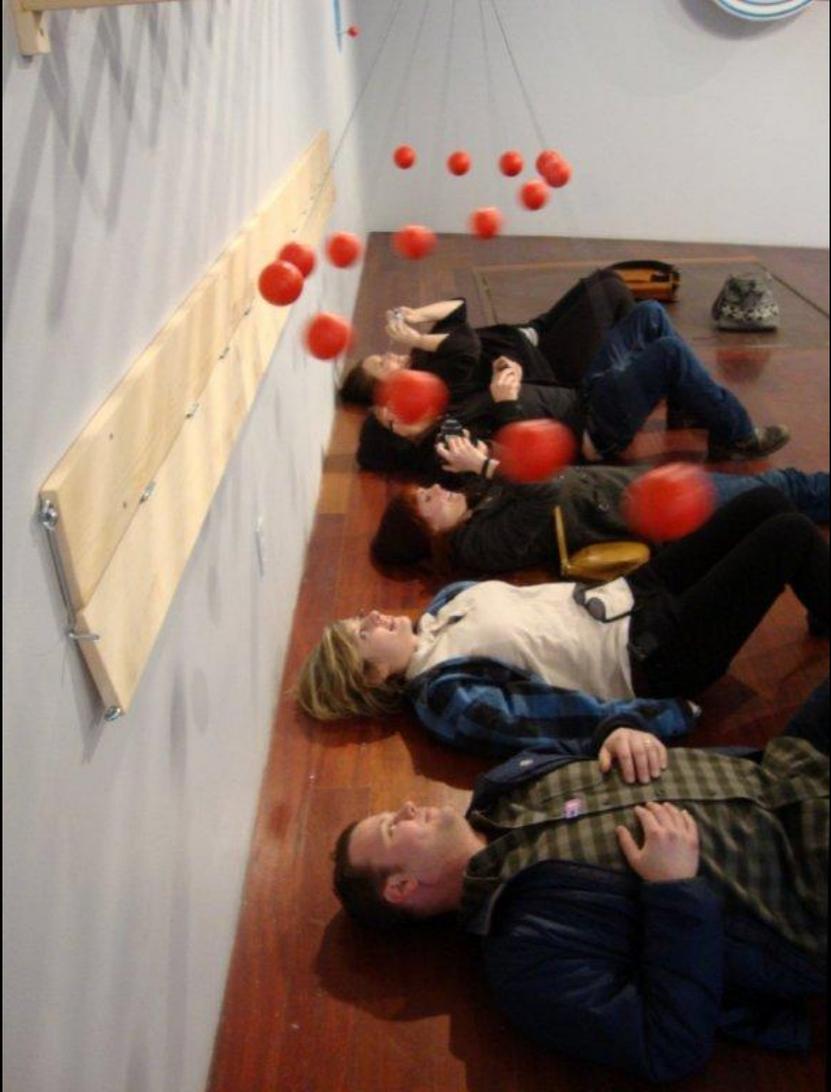


Similar nonlinear coupled chaotic behavior modeled
by an exhibit at the *Cité des Sciences et de l'Industrie*

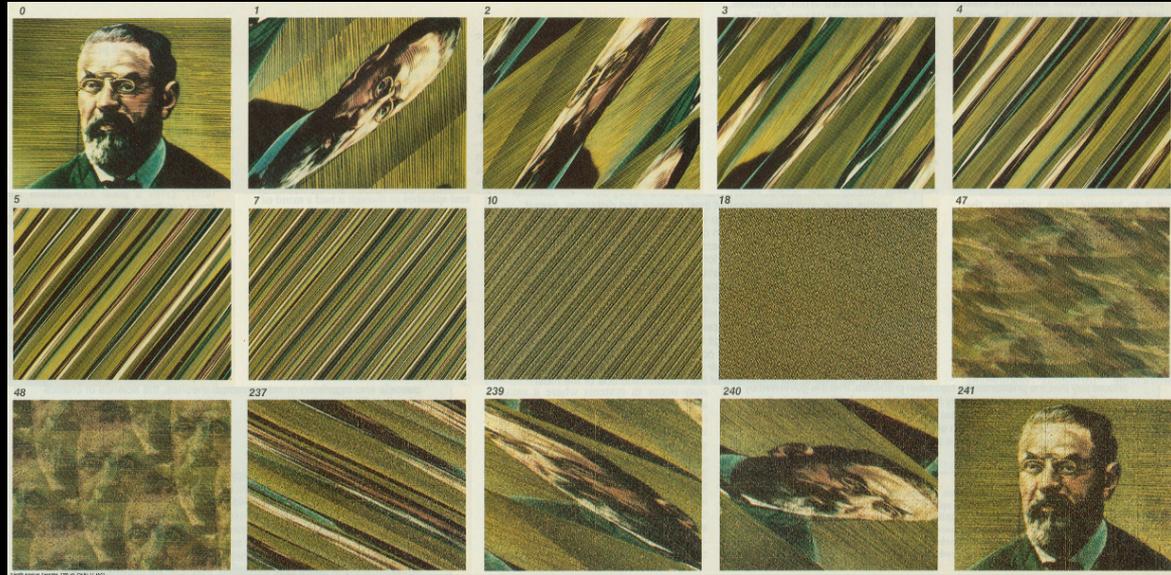






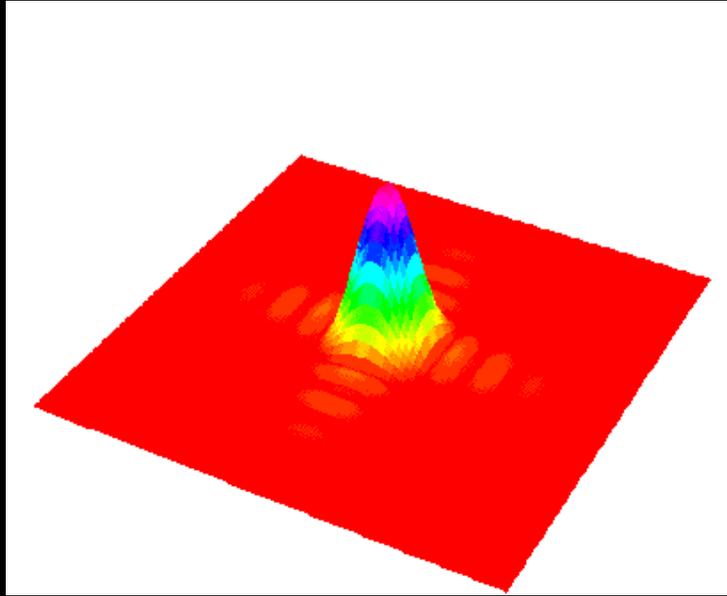


Poincaré Recurrences



With certain assumptions, a system's trajectory will come close to its initial state infinitely many times

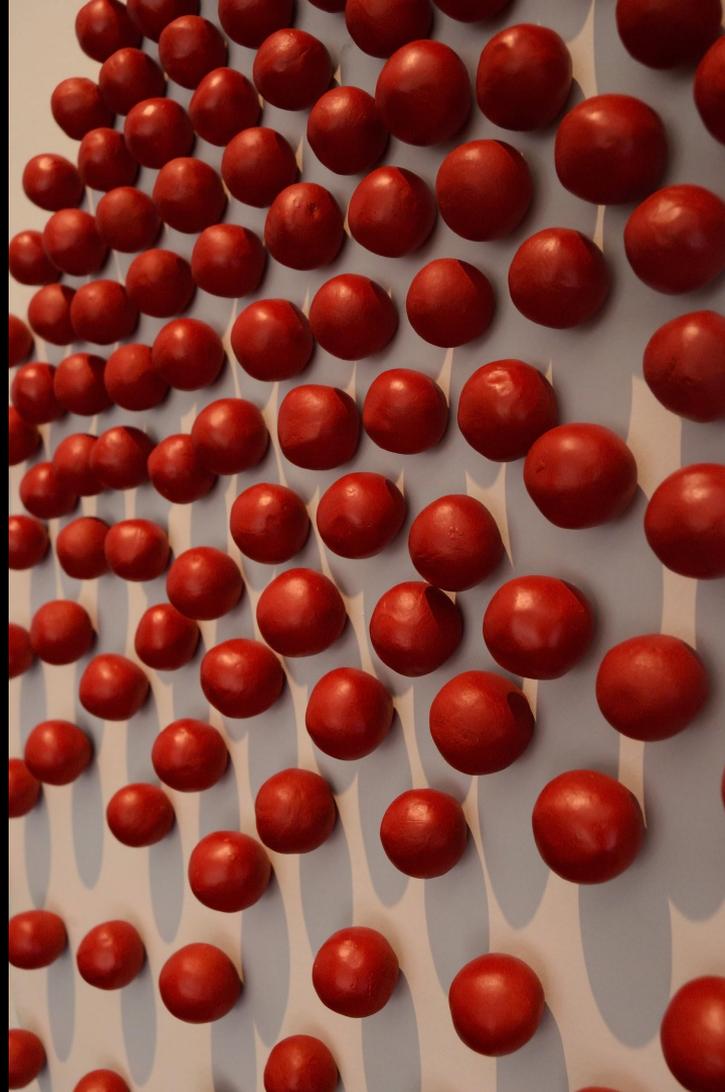
Quantum Revivals



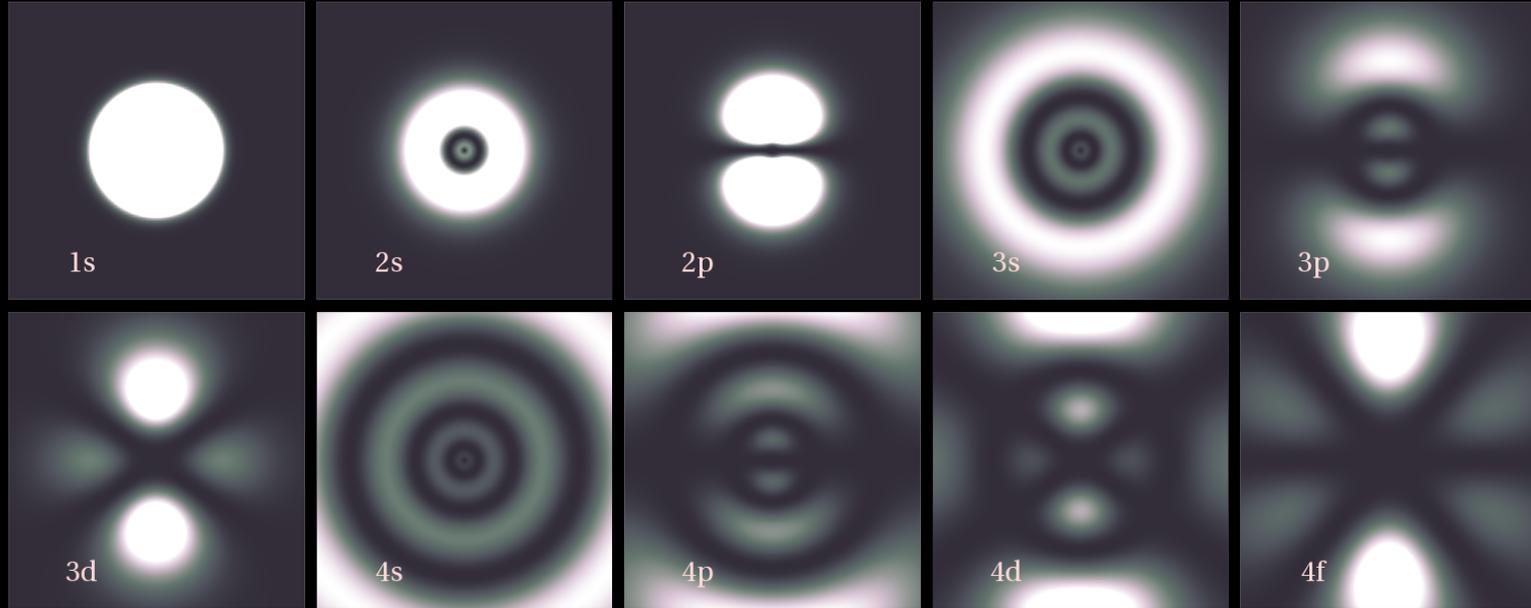
For a quantum particle initially at the center of a square trap, its wave function undergoes revivals







Hydrogen Orbitals



Visualization of where the electron is most likely to be found if its position is measured (depends on state)

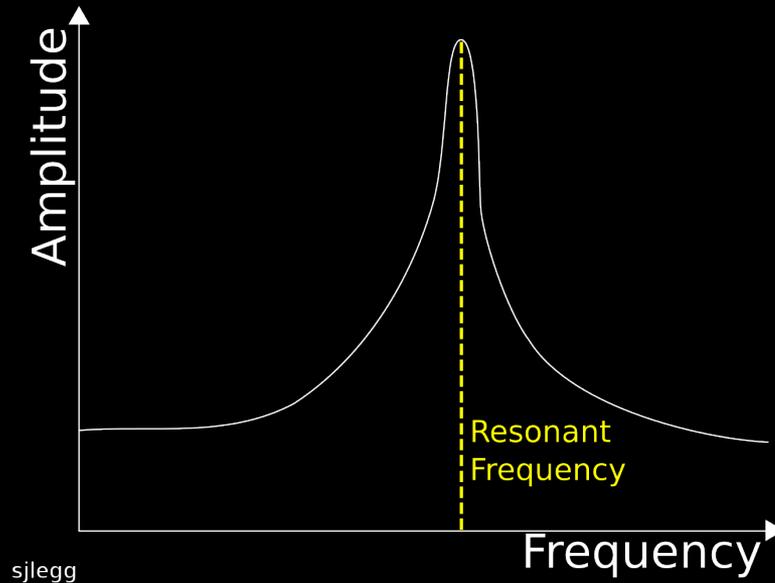






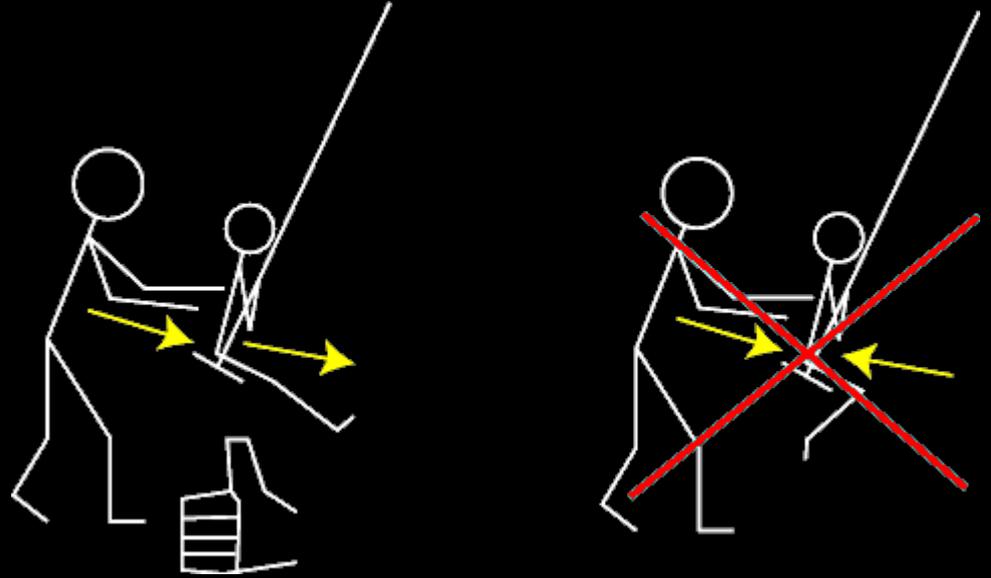


Resonance



The steady-state amplitude of an oscillator is peaked at resonance due to constructive interference

Everyday Examples of Resonance



Resonance is at work in the acoustic shattering of wineglasses and in pushing swings effectively

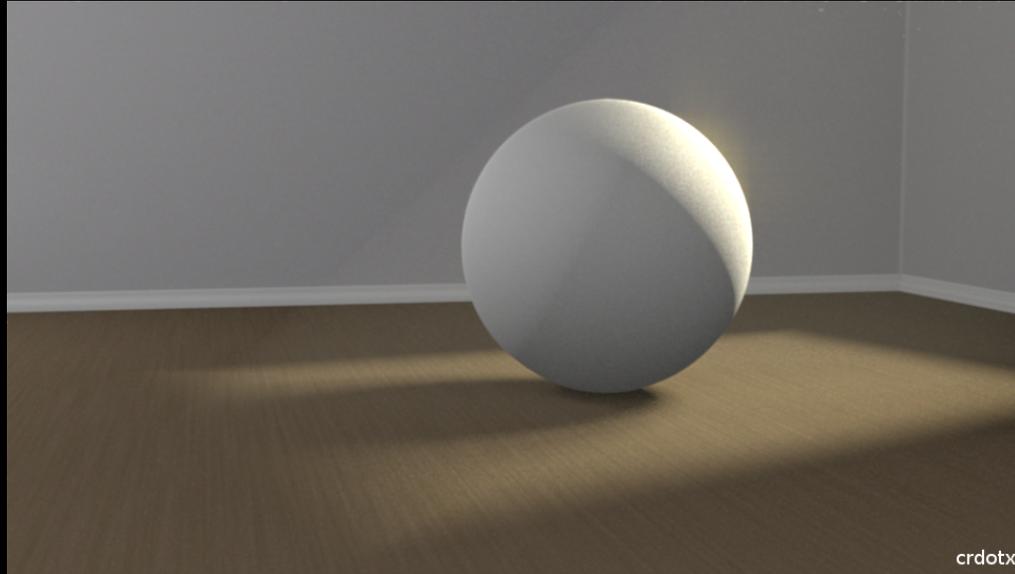


Spheres in Physics



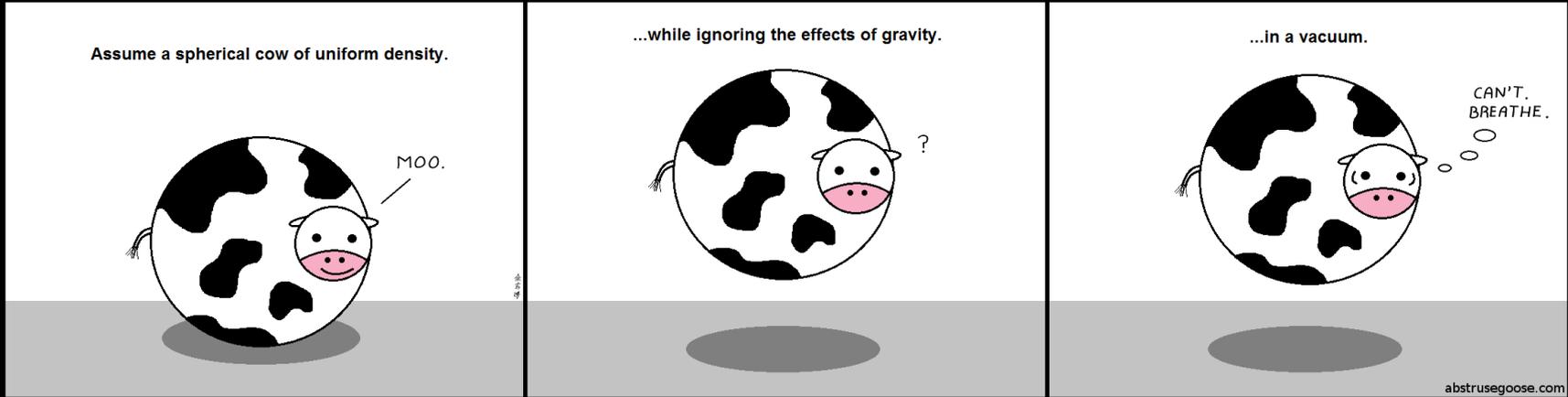
Spheres have been ubiquitous for millennia as tools for trying to understand the physical world

2-Spheres in Mathematics

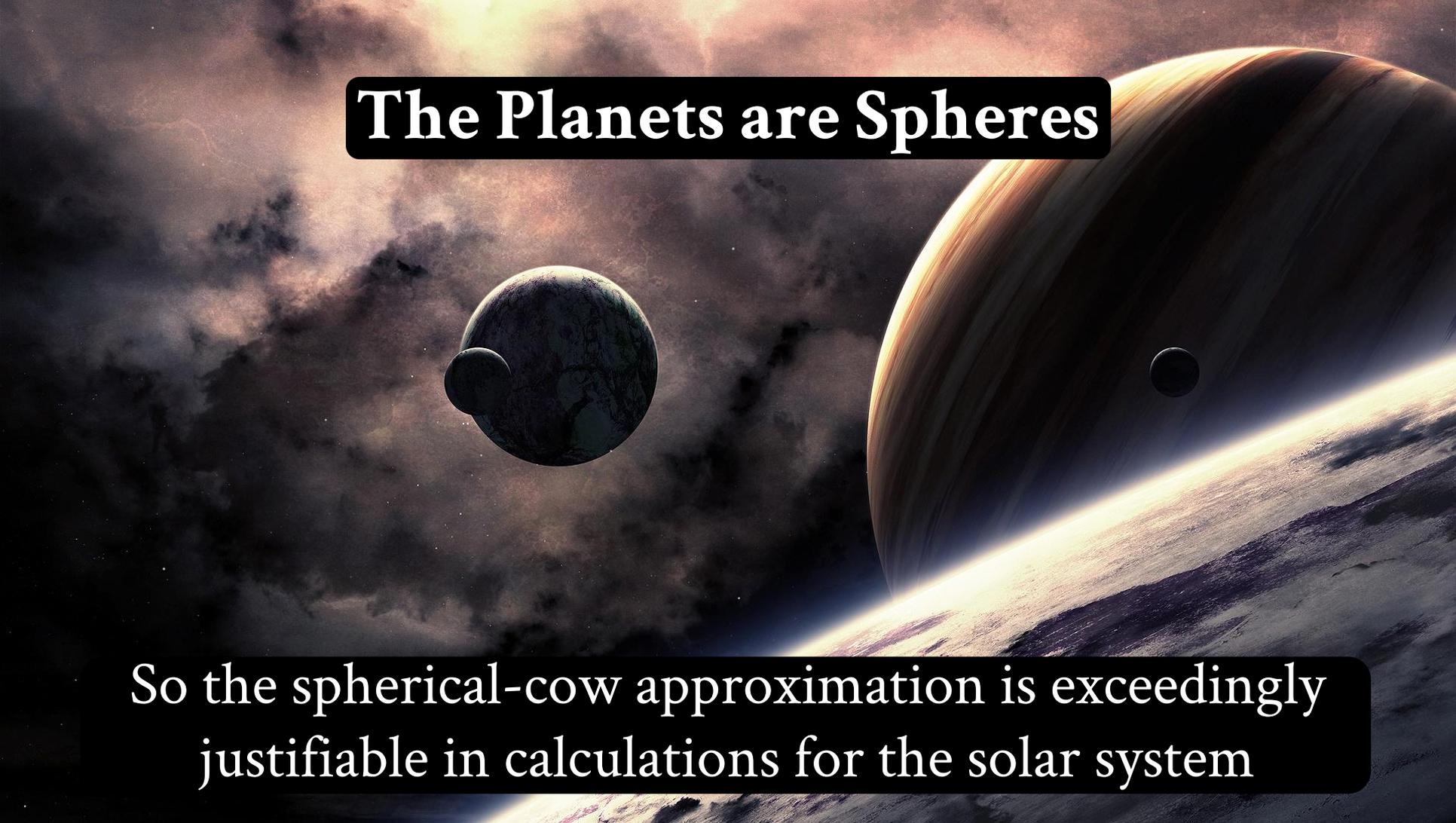


Most symmetric closed & compact surface in 3D space, & has surface of minimal area for its volume

The Spherical-Cow Approximation

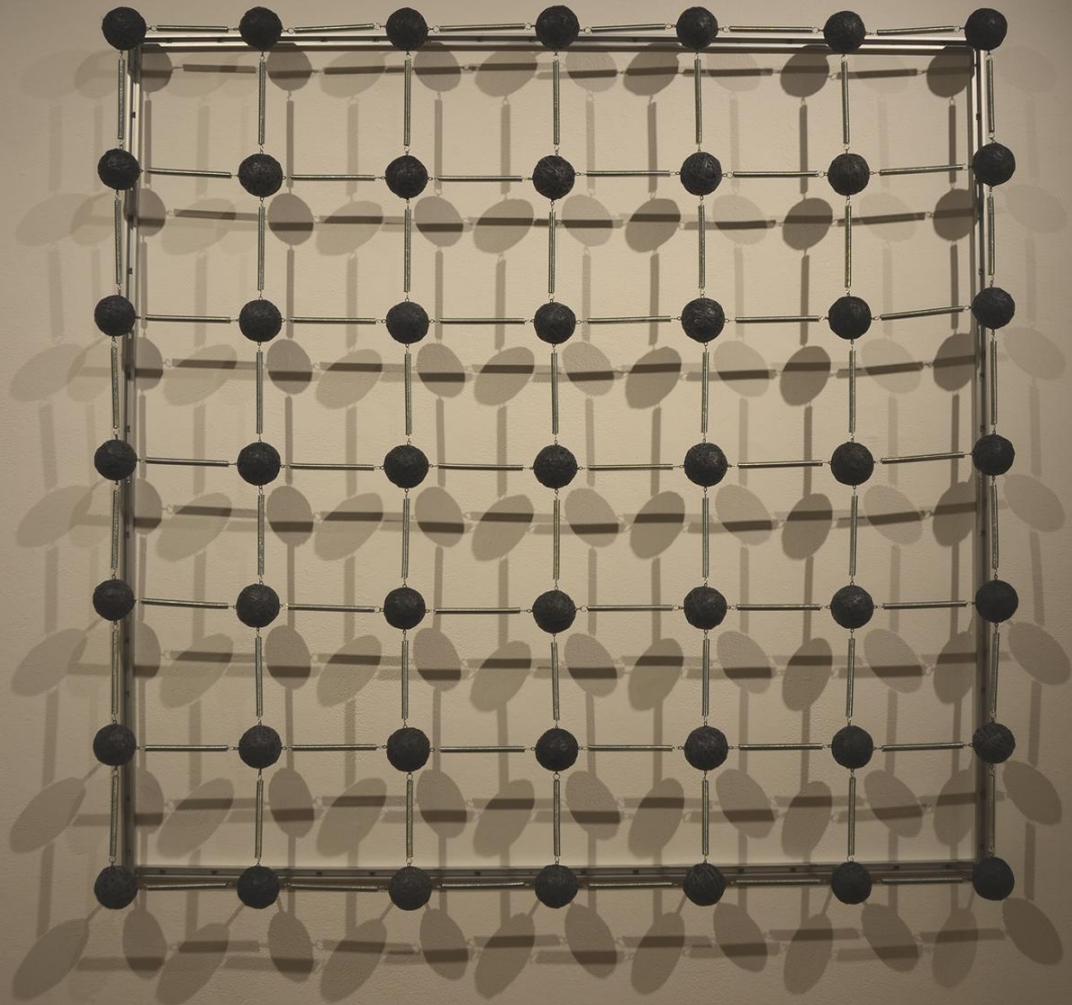


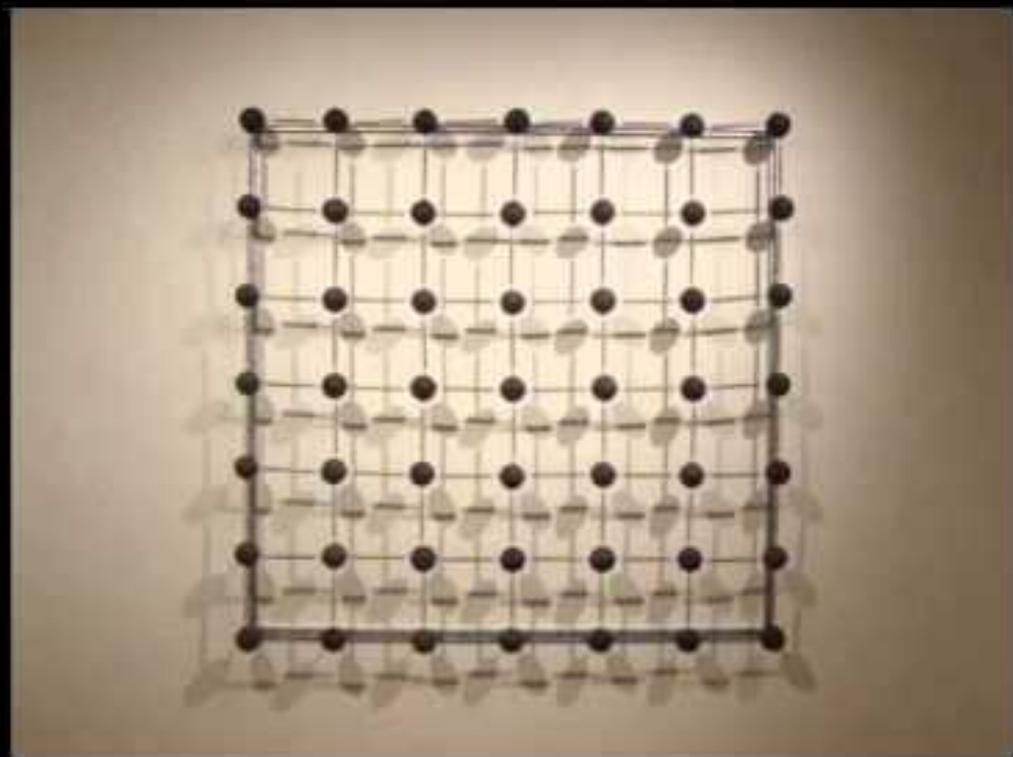
A metaphor for the sometimes-unjustifiable but frequently successful idealizations used by physicists



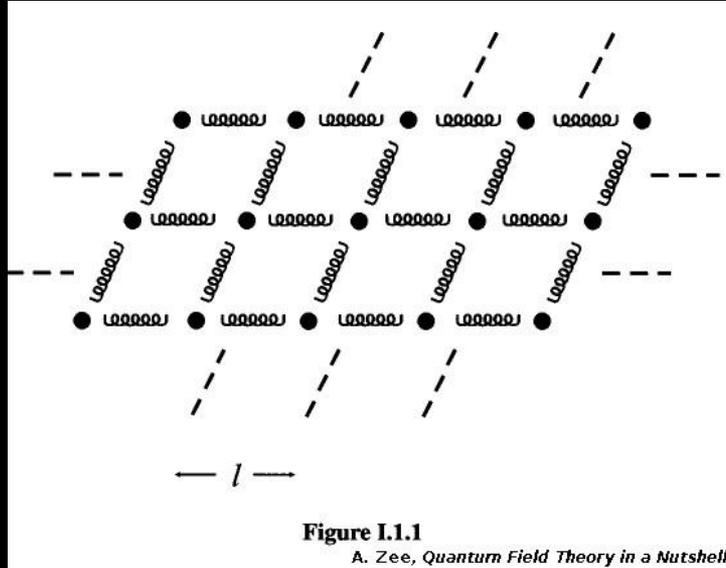
The Planets are Spheres

So the spherical-cow approximation is exceedingly justifiable in calculations for the solar system

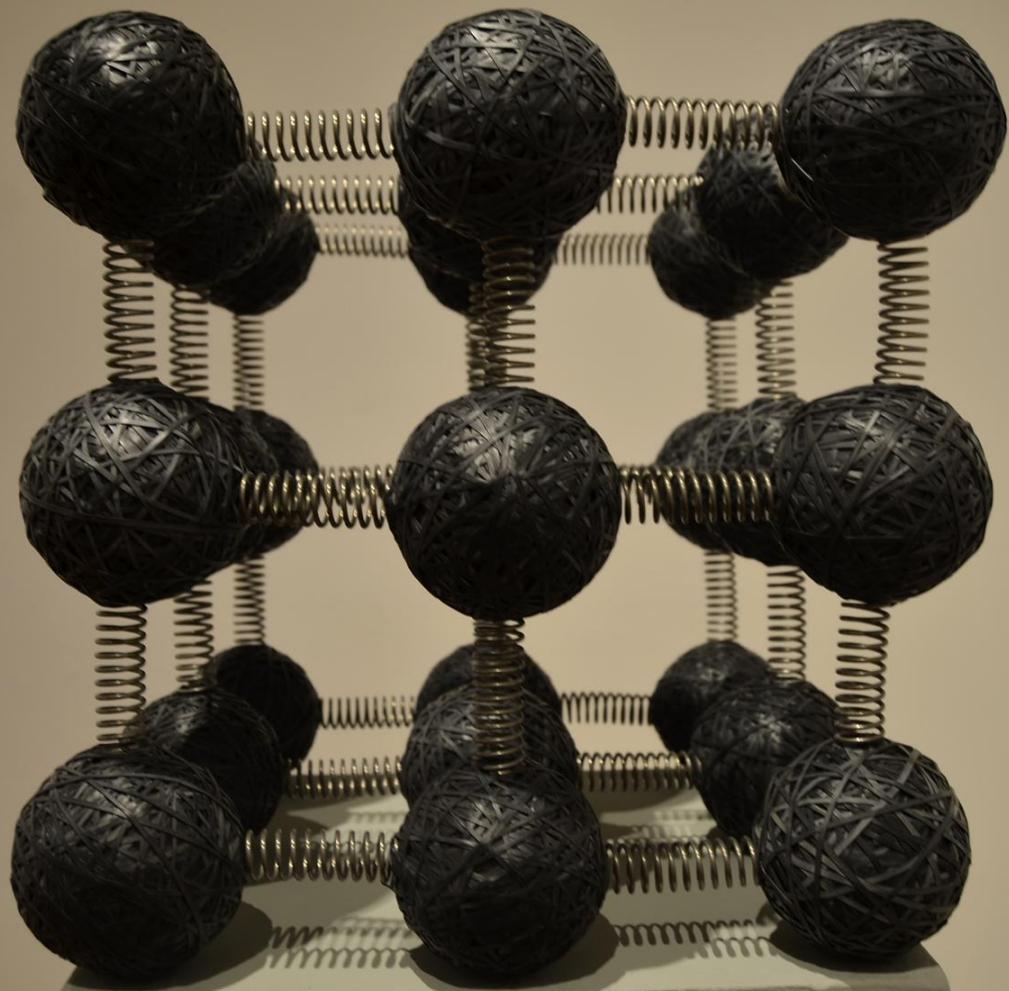




Textbook Quantum Field Theory

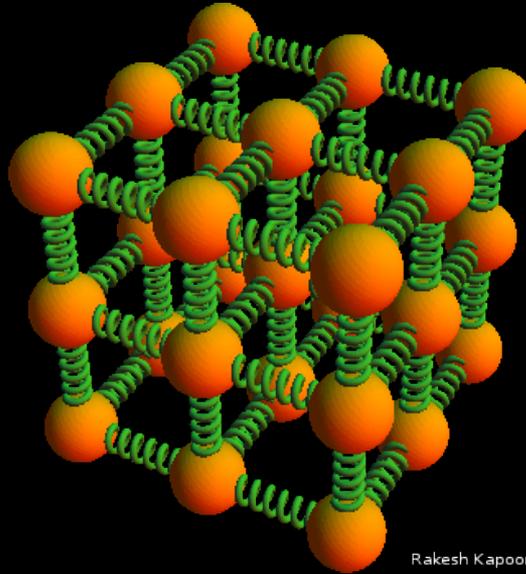


Quantum particles (e.g., photons) are modeled as quantized minimal excitations of quantum fields

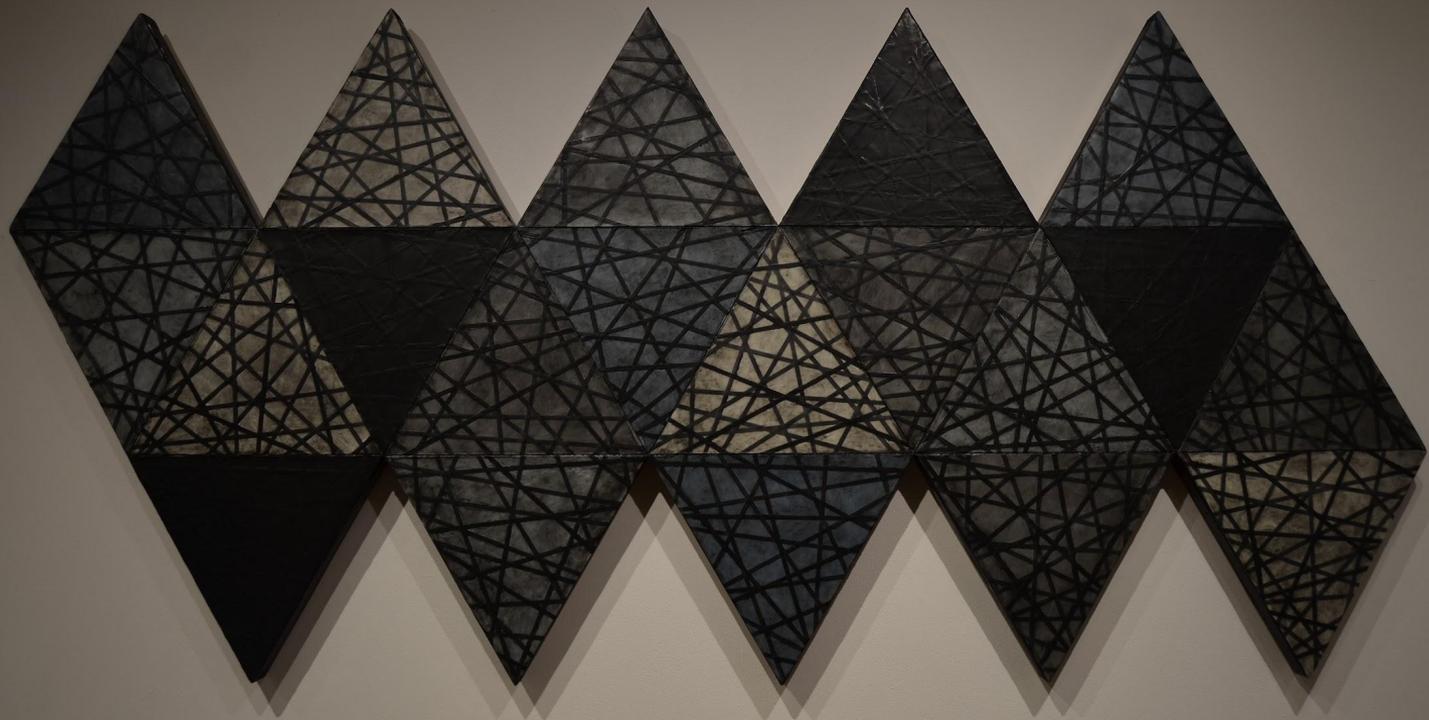




Ball-and-Springs Models



Ball-and-springs models are especially useful for describing the atomic lattices that make up solids





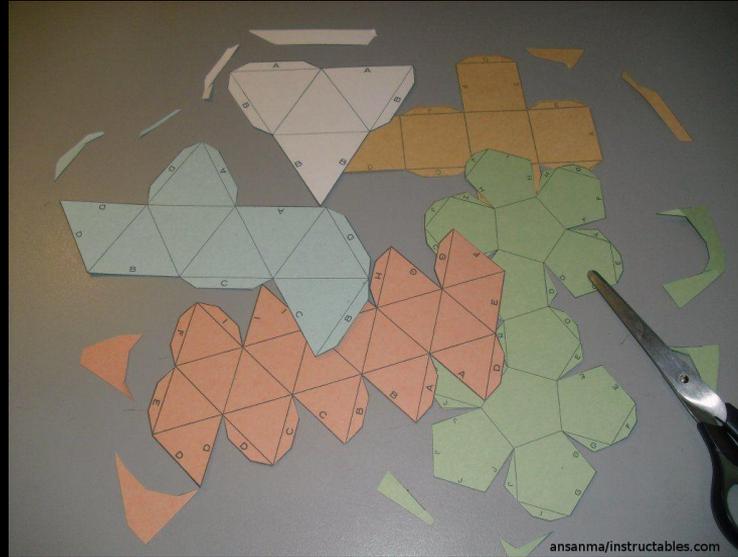
5 Platonic Solids (Regular Polyhedra)



©www.GreatLittleMinds.com

Convex, closed 3D solids whose faces consist of identical equilateral 2D shapes with identical vertices

Nets and the Dürer Conjecture



A connected unfolding is called a net, and the Dürer conjecture asks if every convex polyhedron has a net







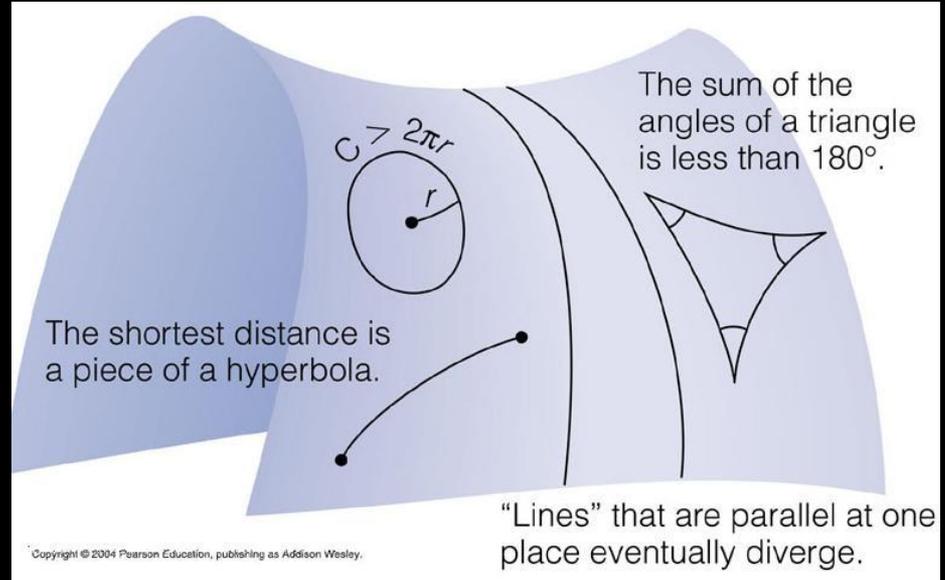
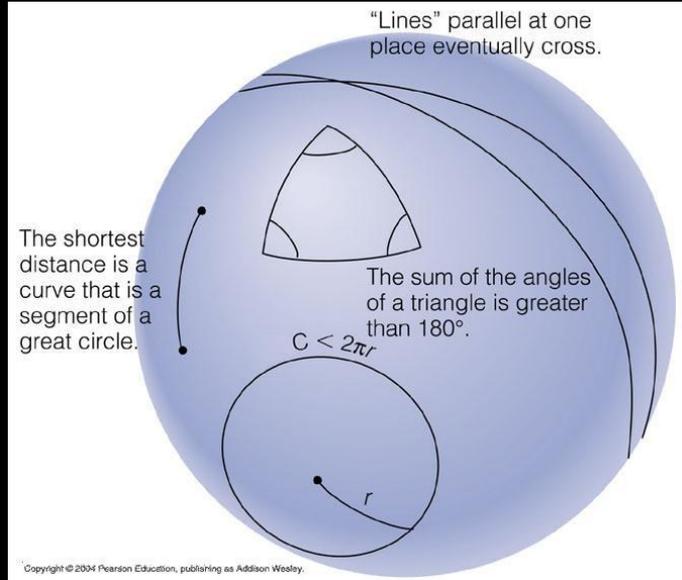
Hyperbolic Surfaces in Coral



Toby Hudson

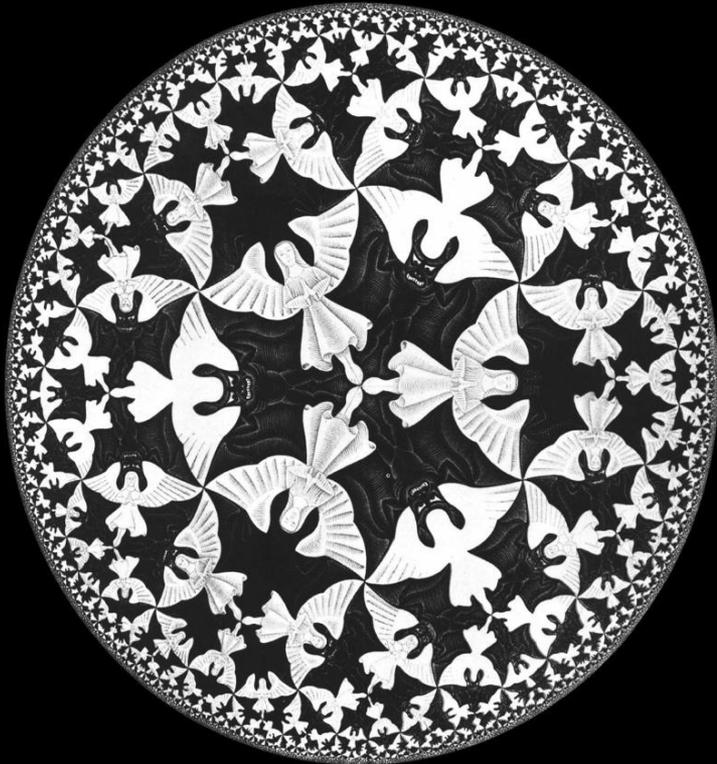


Positive and Negative Curvature



Non-Euclidean surfaces violate the familiar axioms about parallel lines, angle sums, and the value of π

Hyperbolic Surfaces in Escher



A complete 2D hyperbolic surface is infinite, but can be represented on paper by shrinking distances going outward, a technique very useful in general relativity for describing spacetimes



It's Physical
Suffolk University thru Oct 3
Reception: Thurs, Oct 1st, 5-7pm