SYLLABUS for course PHYD38, Title: Nonlinear Physics and Chaos, Winter 2017

Lectures (L) on Mo. in BV 363, 10:00-12:00
Tutorials (T) on Mo. in BV 359, 14:00-15:00

January          February          March          April
16 [L5+6,T2]          20 -- reading wk  20 [L21+22,T10]
30 [L9+10,T4]

*) - midterm, in class, 55 min. We'll start as close to 14:05 as we can.

**) 20.04.17 19-22, MW120

Notes:
This syllabus will change slightly during the course, please download
the updates every week. Numbers in square brackets give chapters
in the Strogatz book.

0. Introduction to the course structure and requirements

INTRODUCTION - DYNAMICAL SYSTEMS AND CHAOS

1. Chaos, Fractals and Dynamics and the
   Importance of being nonlinear [1]

2. 1-D Flows
   Flows on a line [2]
   Bifurcations [3]
   Catastrophes [3]
   Flows on a circle [4]

3. 2-D Flows
   Linear systems [5]
   Phase plane portraits [6]
Limit cycles [7]
Bifurcations again [8]

4. Chaos
Lorenz Equations [9]
1-d maps [10]
Fractals [11]
The exponential fractal
Strange attractors [12]

5. Nonlinear data analysis
Machine Learning, Machine Intelligence
Neural Networks

Postscript:
NONLINEAR WORLD - possible advanced or applied topics for the time after the Strogatz textbook can be chosen from this list:
    Stability and bifurcations in Engineering
        Euler beam buckling as bifurcation
        Nonlinear behavior of materials
    Nonlinearity, chaos and complexity in Physics and Astrophysics
        The three body and N-body systems
            Orbits, Lagrange points, Lyapunov timescales in
            planetary and galactic systems
    Nonlinear continuum mechanics
        Dynamics of incompressible and compressible fluids
        Vortices and turbulence in aerodynamics
        Turbulent jets
    Dynamics of galactic and protoplanetary disks
        Linear and nonlinear stability and evolution
Nonlinear waves, Fluid resonances, Particle resonances

Nonlinear optics

Quantum chaos

Noise and corruption of signals in physical systems

Noise: white, pink, black, non-power law

Convolution, PSF