PHYS 5053   **Data Analysis Methods in Physics**   **Fall 2010**

Course Outline

Introduction.
        What we can, cannot, should, and should not do with data.
        Precision, accuracy, mean, median, variance, standard deviation.

Distributions
        Probability distribution function. Cumulative distribution function.
        Normal, Binomial, and Poisson distributions

Errors and Uncertainties
        Sources of uncertainty
        Propagation of uncertainties
        Criteria for data rejection

Hypothesis Testing and Parameter Estimation
        Least square methods.
        Student's t distribution
        χ^2 test, Kolmogorov-Smirnov test, test for normal distribution.

Correlation and Regression.
        Statistics with two variables. Correlation coefficient. Covariance.
        Fitting methods. Goodness of fit.

Analysis of variance (ANOVA)

Time Series Analysis
        Interpolation. Smoothing. Windows and filters.
        Testing for patterns. Autocorrelation.
        Fourier analysis. Wavelets.

*Multivariate Methods
        Principal component analysis.
        Cluster analysis

*Stochastic vs. deterministic dynamical processes
        Markov chains. Random walks. White noise. Chaos. Fractals.
        Testing for randomness, trends, uniformity, patterns

*Data visualization

Student presentations