# Independent Study ESCI 7621
# (Intermediate Seismology ESCI 7402)
# Spring 2014
# The Seismic Waveform
# 3 credits

Tests of scientific hypotheses concerning solid earth processes rely on a fundamental understanding of seismic wave propagation. Seismic waves are excited by earthquakes and controlled sources and are changed as they propagate through the earth medium. Changes in the phase and amplitude of seismic waves can be used to understand the structure of earth over all distance scales ranging from meters to thousands of the kilometers that can apply to problems as diverse as earthquake hazards and mantle convection. Conversely, knowledge of wave propagation allows high resolution studies of the seismic source.

This course will provide a foundation in seismic wave propagation based on a thorough understanding of point source radiation, plane wave theory, optic ray theory, and point sources in plane-layered media. Prerequisite is a course in partial differential equations.

Course grade will be based on homework (50%) and a term paper (50%).

## Syllabus

1. Analyzing seismic waveforms
    a. Basic wave propagation models
    b. Wave propagation in the earth
    c. Frequency-wavenumber arrays (integral arrays)
    d. Wave Gradiometers (differential arrays)
2. Wave propagation topics
    a. Anelasic attenuation
    b. Scattering attenuation
    c. Anisotropy
    d. Wave continuation (upwards and downwards)
3. Modeling seismic waveforms – vertically inhomogeneous elastic media, body and surface waves
    a. Cagniard-deHoop solutions for line and point sources in plane layered media
    b. Rayleigh's reciprocal theorem and the Representation theorem for elastodynamics.
    c. Point source wave potentials (dislocation and moment tensor sources)
    d. Propagator matrix methods for line sources in plane layered fluid/solid structure
    e. Propagator matrix methods for point sources in plane layered structure
    f. WKBJ ray theory for vertically inhomogeneous media