ECE/METR 6613: Weather Radar Polarimetry

(Formerly called: Wave Interactions with Geophysical Media, Prereq. ECE/METR 5673 is being removed)

Class: Mon.-Wed.-Fri. 2:00pm-2:50pm, NWC5930,
Office hours: Mon. & Wed. 3:00pm-4:00pm, NWC4620,
Instructor: Guifu Zhang (guzhang1@ou.edu), (405)325-3507

Course description
This course provides fundamentals and principles for polarimetric radar remote sensing through understanding wave scattering and propagation in geophysical media subjected to turbulent mixing and filled with hydrometers and other objects. The relations between radar observables and physical parameters will be established. Remote sensing techniques and retrieval methods for physical parameters will be introduced. Applications of polarimetric radar measurements in microphysical parameterization, weather quantification and forecast will be illustrated.

Course Content
Chapter 1: Characterization of hydrometeors
Statistical and electromagnetic properties of hydrometeors (rain, snow, hail ...)
Chapter 2: Wave scattering and absorption by a single particle
Scattering amplitude/cross section for spherical and non-spherical particles: understanding and calculations based on Rayleigh scattering approximation, Mie theory, and T-matrix methods
Chapter 3: Scattering and propagation in media filled with distributed particles
Attenuation/differential attention, phase/differential phase, depolarization, transmission matrix, covariance matrix, spatial/time/frequency correlation of scattered waves from moving scatterers
Chapter 4: Polarimetry radar measurements
Polarization radar variables and their estimates, accuracy of radar measurements, polarization signatures of hydrometeors
Chapter 5: Applications in weather quantification and forecast
Fuzzy logic method for hydrometeor classification, constrained methods for drop size distribution retrieval and accurate precipitation estimation, attenuation corrections, microphysical parameterization, data assimilation

Grading
Homeworks 30%
Projects 40%
Final Examination 30%