

## ECE/METR 6613: Weather Radar Polarimetry

(Formerly called: Wave Interactions with Geophysical Media, Prereq. Graduate status or permission)

**Class:** Mon.-Wed.-Fri. 2:00pm-2:50pm, NWC5930,

**Office hours:** Mon. & Fri. 3:00pm-4:00pm, NWC4620,

**Instructor:** Guifu Zhang (guzhang1@ou.edu), (405)325-3507

**Text:** R. J. Doviak and D. S. Zrnic: *Doppler Radar and Weather Observations*, 2006, 1993, 1984

**References:** A. Ishimaru: *Wave Propagation and Scattering in Random Media*, 1997, 1978

V. N. Bringi and V. Chandrasekar: *Polarimetric Doppler Weather Radar: Principle and applications*, 2001

### Course description

This course provides fundamentals and principles for polarimetric radar remote sensing through understanding wave scattering and propagation in geophysical media filled with hydrometeors and other objects. Physical, statistical and electromagnetic properties of the hydrometeors are characterized. The relations between radar observables and physical state parameters will be established. Advanced remote sensing techniques (e.g., polarimetric phased array radar) and retrieval methods for physical parameters will be introduced. Applications of polarimetric radar measurements in hydrometer classification, particle size distribution retrievals, 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 attenuation, 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%