

# PHYS 721 Atmospheric Radiative Transfer

## Spring 2022

### Dates and Location:

TuTh 10:30AM-11:45AM

Physics 201

**Instructor:** Prof. Zhibo Zhang  
**Phone:** 410-455-6315  
**Email:** Zhibo.Zhang@umbc.edu

**Office Hours:** PHYS417: Thursday 12PM~1:00PM or Email Appointment

### Texts:

No required textbook

### Recommended Books

- “[An Introduction to Atmospheric Radiation \(2<sup>nd</sup> edition\)](#)” By K-N Liou et al.
- “[A First Course in Atmospheric Radiation](#)” by Grant William Petty
- “**Radiative Transfer in the Atmosphere and Ocean**” By Gary E. Thomas, Knut Stamnes
- “**Transfer of Polarized Light in Planetary Atmospheres Basic Concepts and Practical Methods**” by Hovenier et al.

### Grading:

Homework (40%), Midterm Project (30%), Final Project and Presentation (30%)

**Course management:** I will use Blackboard to post course announcements, reading assignments and homework assignments, and post grades. In addition, I will use Google Colab (<https://research.google.com/colaboratory/>) and/or Github (<https://github.com/>) to post the codes, scripts and data for the course

### COURSE OUTLINE:

- ❖ **Overview of atmospheric radiation and radiative transfer**
- ❖ **Part I: Fundamental definition and principles**
  - Maxwell’s equation
  - Electromagnetic wave

- Properties of light and definition of Stokes Vector
- Irradiance, radiance and flux

❖ **Part II: Single Scattering properties of Atmospheric Particles**

- Single Scattering concepts
- Scattering models
- Scattering properties of Aerosols and Clouds

❖ **Part III: From Multiple scattering to Radiative Transfer**

- Definition of radiative transfer equations
- Polarized radiative transfer
- Numerical Radiative Transfer models
- Single Scattering Approximation

❖ **Part IV: Absorption of Atmospheric Gases**

- Absorption lines and broadening effects
- Line-by-line model and band models
- K-distribution model

❖ **Part I: Applications of Radiative Transfer**

- Radiative effects of aerosol and clouds
- Remote sensing
- Climate modeling

## **Accessibility and Disability Accommodations, Guidance and Resources (required)**

Accommodations for students with disabilities are provided for all students with a qualified disability under the Americans with Disabilities Act (ADA & ADAAA) and Section 504 of the Rehabilitation Act who request and are eligible for accommodations. The Office of Student Disability Services (SDS) is the UMBC department designated to coordinate accommodations that creates equal access for students when barriers to participation exist in University courses, programs, or activities.

If you have a documented disability and need to request academic accommodations in your courses, please refer to the SDS website at [sds.umbc.edu](https://sds.umbc.edu) for registration information and office procedures.

SDS email: [disAbility@umbc.edu](mailto:disAbility@umbc.edu)

SDS phone: (410) 455-2459

If you will be using SDS approved accommodations in this class, please contact the instructor to discuss implementation of the accommodations. During remote instruction requirements due to COVID, communication and flexibility will be essential for success.

## **Sexual Assault, Sexual Harassment, and Gender Based Violence and Discrimination (required)**

UMBC Policy and Federal law (Title IX) prohibit discrimination and harassment on the basis of sex, sexual orientation, and gender identity in University programs and activities. Any student who is impacted by sexual harassment, sexual assault, domestic violence, dating violence, stalking, sexual exploitation, gender discrimination, pregnancy discrimination, gender-based harassment or retaliation should contact the University's Title IX Coordinator to make a report and/or access support and resources:

Mikhel A. Kushner, Title IX Coordinator (she/they)

410-455-1250 (direct line), [kushner@umbc.edu](mailto:kushner@umbc.edu)

You can access support and resources even if you do not want to take any further action. You will not be forced to file a formal complaint or police report. Please be aware that the University may take action on its own if essential to protect the safety of the community.

If you are interested in or thinking about making a report, please use the Online Reporting/Referral Form. Please note that, if you report anonymously, the University's ability to respond will be limited.

## **Religious Observances & Accommodations**

UMBC Policy provides that students should not be penalized because of observances of their religious beliefs, and that students shall be given an opportunity, whenever feasible, to make up within a reasonable time any academic assignment that is missed due to individual participation in religious observances. It is the responsibility of the student to inform the instructor of any intended absences or requested modifications for religious observances in advance, and as early as possible. For questions or guidance regarding religious observance accommodations please contact the Office of Equity and Inclusion at [oei@umbc.edu](mailto:oei@umbc.edu).

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Students (and faculty and staff) who experience discrimination, harassment, hate or bias or who have such matters reported to them should use the [online reporting/referral form](#) to report discrimination, hate or bias incidents. You may report incidents that happen to you anonymously. Please note that, if you report anonymously, the University's ability to respond will be limited.