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| **112(1)/2023 Fall Semester TIGP-ESS課程資料表****112(1)/2023 Fall Semester TIGP-ESS course information form** |
| 科目名稱(中文) | 雲物理觀測與模擬 |
| Course Title (English) | Observation and Modeling of Cloud Physics |
| 授課時間Time |  Mon 2p.m.-5 p.m. |
| 授課地點Location |  Room 2034, RCEC Building, Academia Sinica |
| 學分數Course Credits | 3 |
| 主要授課老師Main Instructors | Liu, Chian-Yi(劉千義)、Kao-Shen Chung(鍾高陞) |
| 聯絡郵件E-mail | cyliu7@gate.sinica.edu.tw ; kschung@g.ncu.edu.tw  |
| 辦公時間Office Hours |  Mon 3-5p.m. in RCEC R7037 or by appointment |
| 課程目標Course Objectives | To understand the essential parts of cloud and precipitation physics. |
| 授課內容Course Description | The in-situ and remote sensing of cloud and precipitation; formation of cloud droplets and growth by condensation; initiation of rain in non-freezing and freezing clouds; precipitation processes |
| 教科書/參考書Textbooks/References | 1. “A First Course in Atmospheric Radiation (2nd Ed.)” by Petty, G., Sundog Publishing, 2016, 472 pp
2. “A Short Course in Cloud Physics, 3rd Edition” by Rogers, R.R., and M.K. Yau, Pergamon Press293 pp
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| 自編教材比例Self-compiled Textbook/References Proportion(if any) |  (限數字 0~100) |
| 授課方式Course Requirements | ■講授(Lecture)；■研討(Seminar)；□實習/實驗(Internship/Experiment)；□個別指導(Individual Discussion)；□其他(Other) |
| 評量配分比重Course Grade | mid-term exam (40%)final exam (40%)homework and project report (if any) (20%) |
| 課程領域Areas | □基礎學科(共同)(Basic subjects (common)) □固態地球科學(Solid earth sciences) □水圈科學(Aquatic sciences) □應用語言(Applied Languages) ■大氣科學(Atmospheric sciences) |
| 產業領域Areas | □地探科技(Geological monitoring technology) ■氣象科技(meteorological science and technology) □太空科技(Space Technology) □環保科技(environmental protection science and technology) □資訊科技(Informational Technology) □教學研究(Teaching & research) □地質科技(Geosciences and technology) |
| 課程進度與內容Lecture outline and content |
| 週次week | 主題Topic | 授課教師/指定閱讀或作業Instructor/Readings or assignments |
| **1** | **9/11** | Introduction | Liu, Chian-Yi(劉千義) |
| **2** | **9/18** | Observation system – in-situ | Liu, Chian-Yi(劉千義) |
| **3** | **9/23** | Observation system – remote sensing | Liu, Chian-Yi(劉千義) |
| **4** | **9/25** | Radiative transfer of the cloud – reflection and scattering (1) | Liu, Chian-Yi(劉千義)/Petty (2016) |
| **5** | **10/2** | Radiative transfer of the cloud – scattering (2) and emission | Liu, Chian-Yi(劉千義)/Petty (2016) |
| **6** | **10/16** | Retrieval of the cloud microphysics and properties (1) | Liu, Chian-Yi(劉千義) |
| **7** | **10/23** | Retrieval of the cloud microphysics and properties (2) | Liu, Chian-Yi(劉千義) |
| **8** | **10/30** | Validation and evaluation | Liu, Chian-Yi(劉千義) |
| **9** | **11/6** | Mid-term exam | Liu, Chian-Yi(劉千義) |
| **10** | **11/13** | Thermodynamics and Atmospheric stability | Kao-Shen Chung(鍾高陞) |
| **11** | **11/20** | Thermodynamics and Atmospheric stability | Kao-Shen Chung(鍾高陞) |
| **12** | **11/27** | Formation of cloud Droplets | Kao-Shen Chung(鍾高陞) |
| **13** | **12/4** | Droplet Growth by Condensation | Kao-Shen Chung(鍾高陞) |
| **14** | **12/11** | Warm rain / Cold rain process | Kao-Shen Chung(鍾高陞) |
| **15** | **12/18** | Warm rain / Cold rain process | Kao-Shen Chung(鍾高陞) |
| **16** | **12/25** | Observation v.s. Simulation | Kao-Shen Chung(鍾高陞) |
| **17** | **1/1** | Holiday |  |
| **18** | **1/8** | Final exam |  |
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| 課程所屬學制(Educational System): 博士班(Doctoral Program) |
| 核心能力I: 請點選本課程培養學生具備核心能力之強度指數，並填寫對應之評量方式Please select core abilities and its corresponding assessments of this course |
| 請勾選學程所訂之核心能力(可複選)■獨立思考與研究能力Independent thinking and research capacity■進階數理及專業知識能力Advanced mathematical and professional knowledge and ability■觀測模擬及分析推理能力Observation simulation and analysis of reasoning ability□電腦及程式語言運用能力Computer and programming language proficiency□國際視野與語文溝通能力International perspective and language communication skills□專業倫理及服務學習能力Professional ethics and service-learning ability |
| 核心能力II: 請點選本課程培養學生具備核心能力之強度指數，並填寫對應之評量方式Please select the core abilities and its corresponding assessments of this course |
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| 強度指數Overall ratingof Core Abilities | 1非常低Very Low | 2低Low | 3普通Medium | 4高High | 5非常高Very High | 評量方式Corresponding Assessments |
| 獨立思考與研究能力Independent thinking and research capacity | □ | □ | □ | ■ | □ | □紙筆測驗/會考(Test/Exam) □作業練習(Assignments) □口頭報告/口試(Presentation/Oral Exam) □專題研究報告(書面)(Research Report(printed on paper)) □實作/實驗(Practices/Experiments) □出席/課堂表現(Attendance/Performance) □學習檔案評量(Portfolios Assessment) □自我評量/同儕互評(Self-Assessment/ Peer Assessment) □作品/創作展演(Products/Creative Performance) □其他(Others)  |
| 進階數理及專業知識能力Advanced mathematical and professional knowledge and ability | □ | □ | □ | ■ | □ | □紙筆測驗/會考(Test/Exam) □作業練習(Assignments) □口頭報告/口試(Presentation/Oral Exam) □專題研究報告(書面)(Research Report(printed on paper)) □實作/實驗(Practices/Experiments) □出席/課堂表現(Attendance/Performance) □學習檔案評量(Portfolios Assessment) □自我評量/同儕互評(Self-Assessment/ Peer Assessment) □作品/創作展演(Products/Creative Performance) □其他(Others)  |
| 觀測模擬及分析推理能力Observation simulation and analysis of reasoning ability | □ | □ | □ | ■ | □ | □紙筆測驗/會考(Test/Exam) □作業練習(Assignments) □口頭報告/口試(Presentation/Oral Exam) □專題研究報告(書面)(Research Report(printed on paper)) □實作/實驗(Practices/Experiments) □出席/課堂表現(Attendance/Performance) □學習檔案評量(Portfolios Assessment) □自我評量/同儕互評(Self-Assessment/ Peer Assessment) □作品/創作展演(Products/Creative Performance) □其他(Others)  |
| 電腦及程式語言運用能力Computer and programming language proficiency | □ | □ | ■ | □ | □ | □紙筆測驗/會考(Test/Exam) □作業練習(Assignments) □口頭報告/口試(Presentation/Oral Exam) □專題研究報告(書面)(Research Report(printed on paper)) □實作/實驗(Practices/Experiments) □出席/課堂表現(Attendance/Performance) □學習檔案評量(Portfolios Assessment) □自我評量/同儕互評(Self-Assessment/ Peer Assessment) □作品/創作展演(Products/Creative Performance) □其他(Others)  |
| 國際視野與語文溝通能力International perspective and language communication skills | □ | □ | □ | ■ | □ | □紙筆測驗/會考(Test/Exam) □作業練習(Assignments) □口頭報告/口試(Presentation/Oral Exam) □專題研究報告(書面)(Research Report(printed on paper)) □實作/實驗(Practices/Experiments) □出席/課堂表現(Attendance/Performance) □學習檔案評量(Portfolios Assessment) □自我評量/同儕互評(Self-Assessment/ Peer Assessment) □作品/創作展演(Products/Creative Performance) □其他(Others)  |
| 專業倫理及服務學習之能力Professional ethics and service-learning ability | □ | □ | ■ | □ | □ | □紙筆測驗/會考(Test/Exam) □作業練習(Assignments) □口頭報告/口試(Presentation/Oral Exam) □專題研究報告(書面)(Research Report(printed on paper)) □實作/實驗(Practices/Experiments) □出席/課堂表現(Attendance/Performance) □學習檔案評量(Portfolios Assessment) □自我評量/同儕互評(Self-Assessment/ Peer Assessment) □作品/創作展演(Products/Creative Performance) □其他(Others)  |

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