

课程大纲

COURSE SYLLABUS

1.	课程代码/名称 Course Code/Title	自适应光学/Adaptive Optics
2.	课程性质 Compulsory/Elective	专业选修课
3.	课程学分/学时 Course Credit/Hours	3 学分/48 学时 3 Credit/48Hours
4.	授课语言 Teaching Language	中文&英语/ Chinese & English
5.	授课教师 Instructor(s)	李依明/Yiming Li
6.	是否面向本科生开放 Open to undergraduates or not	无/NA
7.	先修要求 Pre-requisites	(如面向本科生开放, 请注明区分内容。 If the course is open to undergraduates, please indicate the difference.) 无/NA
8.	教学目标 Course Objectives	(如面向本科生开放, 请注明区分内容。 If the course is open to undergraduates, please indicate the difference.) 了解光的不同物理性质, 光传播过程中的理论和建模方法。掌握成像系统中的常见像差以及校正方法。掌握自适应光学在不同显微成像系统中的应用。通过理论和代码实践, 具备对系统中不同像差的数学建模并将其应用到不同显微成像系统的能力。
9.	教学方法 Teaching Methods	(如面向本科生开放, 请注明区分内容。 If the course is open to undergraduates, please indicate the difference.) 课堂讲授+项目设计+演讲
10.	教学内容 Course Contents	(如面向本科生开放, 请注明区分内容。 If the course is open to undergraduates, please indicate the difference.)
	Section 1	Introduction: Overview of adaptive optics in biological Imaging
	Section 2	Fundamentals of Adaptive Optics I: Complex fields, Wave equations, Light propagation, interferometry
	Section 3	Fundamentals of Adaptive Optics II: Ray tracing, Matrix approach, Imaging, paraxial optics
	Section 4	Fundamentals of Adaptive Optics III: Energy, photon statistics, Fluorescence, FRET, Scattering
	Section 5	Lasers in Adaptive Optics: Principle, Resonators, Modes, Laser types, Pulses, Power
	Section 6	Image formation in Adaptive Optics: Transfer function, spatial frequency

	model, 4f-systems
Section 7	PSF engineering: Point spread function calculation, resolution, Strehl ratio, Extended depth of focus
Section 8	Aberrations: Simulations of aberrations, Zernike mode
Section 9	Adaptive optics system: Deformable mirror, Spatial light modulator, Shack-Hartmann Sensor, etc
Section 10	Sensorless adaptive optics for microscopy
Section 11	Adaptive optics in confocal microscopy
Section 12	Adaptive optics in Wide-Field Microscopy
Section 13	Nonlinear Optics with Adaptive Optics: Basics of nonlinear optics, 2 nd and 3 rd order effects, 2 photon imaging
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11. 课程考核 Course Assessment	
<p>(① 考核形式 Form of examination; ②. 分数构成 grading policy; ③ 如面向本科生开放, 请注明区分内容。 If the course is open to undergraduates, please indicate the difference.)</p> <p>出勤 10% 平时作业 30% 大作业 40% 课程报告: 20%</p>	
12. 教材及其它参考资料 Textbook and Supplementary Readings	
<p>Principles of Optics, Max Born, Emil Wolf, Cambridge University Press; 7th edition, ISBN-13: 978-0521642224</p> <p>Adaptive Optics for Biological Imaging, Joel A Kubby, CRC Press, ISBN 9781439850183</p>	