

# 课程大纲

## COURSE SYLLABUS

1.	<b>课程代码/名称</b> <b>Course Code/Title</b>	<b>MSE5028 光子科学在材料研究和交叉前沿的应用</b> <b>Photon science and its application to materials research and interdisciplinary frontiers</b>				
2.	<b>课程性质</b> <b>Compulsory/Elective</b>	专业选修课				
3.	<b>课程学分/学时</b> <b>Course Credit/Hours</b>	3/48				
4.	<b>授课语言</b> <b>Teaching Language</b>	英文/English				
5.	<b>授课教师</b> <b>Instructor(s)</b>	冯军 教授				
6.	<b>是否面向本科生开放</b> <b>Open to undergraduates or not</b>	是				
7.	<b>先修要求</b> <b>Pre-requisites</b>	大学物理, general physics.				
8.	<b>教学目标</b> <b>Course Objectives</b>	<p>光子科学是当今世界最重要的前沿科研领域之一。它不仅产生了众多的诺贝尔奖，还催生了量子科学的诞生。为了纪念光子科学对人类的重大贡献，联合国将 2015 年命名为国际光年。在中国，投资 50 亿的北京高能光源和投资 100 亿的上海光源、以及投资 40 亿的北京超快激光设施都已进入工程建设，预计 2025 年这些重大科研设施将投入使用进行科学研究。本课程对光子科学的基础理论及测量原理进行介绍，重点是光子科学的前沿领域及应用。光子科学的前沿是超快光子脉冲的产生、测量、调控和应用。目标是从事材料科学、物理、化学与生物等专业的学生提供动力学和超快现象科学研究的新方向和新方法，为探索前沿科学研究奠定坚实的基础。</p> <p>This class introduces the broad field of photon source and their applications to the senior undergraduate and graduate students. The frontier and application of photon science is study ultrafast phenomena in the microscopic world. This leads to the development of femtosecond photon sources such as ultrafast laser, ultrafast x-ray and free electron laser. This advanced photon sources' excellence is acknowledged by outstanding scientific record with directly contributing to work leading to many Nobel Prizes in physics, chemistry, and biology. In China, both Beijing high energy photon source and Shanghai free electron laser light source are fully funded under construction phase. This class is designed for students who have been exposed to material science; physics, chemistry as well as biology, and wish to have a basic understanding of ultrafast photon source and its application in science research. The main purpose is to reveal basic principle and frontiers, experimental technique, and instrumentation and detecting technology associated with the ultrafast photon sources.</p> <p>At the end of this class, students are expected to be familiar with the principle, experimental techniques of advanced photon source. The students will have entry level knowledge of ultrafast science experimental technique and the frontier research topics in ultrafast science. The students will learn to perform literature search, develop understanding of recent advances in photon science. Students will benefit from this class for their future research both in China and abroad.</p>				
9.	<b>教学方法</b> <b>Teaching Methods</b>	讲授，课堂练习，文献阅读讨论，				
10.	<b>教学内容</b> <b>Course Contents</b>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;"><b>Section 1</b></td> <td>光子科学和超快现象 (4 学时) Photon science and ultrafast phenomena (4 Credit hours)</td> </tr> <tr> <td><b>Section 2</b></td> <td>光子的本质 (4 学时) the nature of light (6 Credit hours)</td> </tr> </table>	<b>Section 1</b>	光子科学和超快现象 (4 学时) Photon science and ultrafast phenomena (4 Credit hours)	<b>Section 2</b>	光子的本质 (4 学时) the nature of light (6 Credit hours)
<b>Section 1</b>	光子科学和超快现象 (4 学时) Photon science and ultrafast phenomena (4 Credit hours)					
<b>Section 2</b>	光子的本质 (4 学时) the nature of light (6 Credit hours)					

<b>Section 3</b>	光子的量子理论（4学时） quantum theory of light (6 Credit hours)
<b>Section 4</b>	光子和物质相互作用（6学时） photon interaction with matter (6 Credit hours)
<b>Section 5</b>	超快激光和时间维度测量（6学时） ultrafast laser and time measurement (6 Credit hours)
<b>Section 6</b>	同步辐射和自由电子激光（6学时） Synchrotron radiation and free electron laser (6 Credit hours)
<b>Section 7</b>	材料研究原位探测（6学时） In-situ detection for materials research(6 Credit hours)
<b>Section 8</b>	超快光子调控（6学时） ultrafast photon manipulation (6 Credit hours)
<b>Section 9</b>	超快科学（6学时） ultrafast science (6 Credit hours)
<b>11. 课程考核 Course Assessment</b>	
Attendance: 10% Class performance: 10% Projects: 10% Mid-term test: 10% Final exam: 40% Final presentation: 20%	
<b>12. 教材及其它参考资料 Textbook and Supplementary Readings</b>	
1. Progress in Photon Science, Editors: Yamanouchi, Kaoru, Tunik, Sergey, Makarov, Vladimir A, Publisher: Springer, 2019, ISBN 978-3-030-05974-3 2. published journal references	