

研究生课程教学大纲（Syllabus）

课程代码 Course Code	ASTR8305	*学时 Teaching Hours	48	*学分 Credits	3
*课程名称 Course Name	天文学统计方法				
	Statistical methods for astronomy				
*授课语言 Instruction Language	English				
*开课院系 School	物理与天文学院				
先修课程 Prerequisite					
授课教师 Instructors	姓名 Name	职称 Title	单位 Department	联系方式 E-mail	
	Sonnenfeld Alessandro		天文系	sonnenfeld@sjtu.edu.cn	
*课程简介（中文） Course Description	<p>无论是实验家还是理论家，解释观察结果都是科学家的一项基本工作。统计学使我们有可能完成这项任务，让我们能够根据现有数据对物理系统的性质做出定量说明。然而，决定在特定情况下采用何种统计方法并非易事，这取决于所涉及的数据类型，最终还取决于我们想要解决的科学问题。善用或误用统计方法，可能会带来重大发现或错误结论。</p> <p>本课程涵盖天文观测分析中最常用的统计方法。学生将学习如何从嘈杂的数据中提取准确的信息，发现规律，拟合模型，并对未来的观测做出预测。</p> <p>最重要的是，学生将学习每种统计方法的优点和局限性，以及如何从统计角度最有效地解决每个观测问题。</p>				

<p>*课程简介 (English) Course Description</p>	<p>Interpreting observations is a fundamental part of the job of a scientist, experimentalist or theorist alike. Statistics makes it possible to accomplish this task, allowing us to make quantitative statements on the nature of a physical system on the basis of the available data. However, the decision of what statistical method to apply in a given situation is not a trivial one, but depends on the type of data involved and, ultimately, on the scientific question that one wants to address. The good use, or the misuse, of statistics can make the difference between a discovery or a false claim.</p> <p>This course covers the statistical methods that are most commonly used in the analysis of astronomical observations. The student will learn how to extract accurate information from noisy data, find patterns, fit models, and make predictions on future observations.</p> <p>Most importantly, he or she will learn the advantages and limitation of each statistical method, and how to best tackle each observational problem from a statistical point of view.</p>				
<p>*教学安排 Schedules</p>	<p>周次 Week</p>	<p>教学内容 Content</p>	<p>授课学时 Hours</p>	<p>教学方式 Format</p>	<p>授课教师 Instructor</p>
	1	Probability theory	3		
	2	Frequentist statistics	3		
	3	Maximum likelihood estimation	3		
	4	Fisher matrix forecast	3		
	5	Uncertainty estimation: bootstrap and jackknife	3		
	6	Bayesian statistics	3		
	7	One-dimensional problems	3		
	8	Multi-dimensional problems	3		
	9	Bayesian hierarchical models	3		
	10	Sampling techniques	3		
	11	Model comparison	3		
	12	Basics of machine learning	3		
	13	Classifiers	3		

	14	Statistical challenges in astronomy (I)	3		
	15	Statistical challenges in astronomy (II)	3		
	16	Final exam	3		
*考核方式 Grading Policy	50% homework, 50% final exam				
*教材或参考资料 Textbooks & References	Ivezic, Z. et al. "Statistics, Data Mining, and Machine Learning in Astronomy", Princeton University Press Gelman, A. et al. "Bayesian data analysis, 3rd edition"				
备注 Notes					

备注说明：

1. 带\*内容为必填项；
2. 课程简介字数为 300-500 字；教学内容、进度安排等以表述清楚教学安排为宜，字数不限。