NASSP Honours Course Template

Course Title:	**SPECTROSCOPY**
Course Lecturer:	**DR ROSALIND SKELTON (SAAO)**
Course credits:	1
Lecturer contact hours:	24
Tutorial/practical hours:	6

1) Course overview:
Spectroscopy is one of the most important tools used by astronomers for studying the universe. This course will cover aspects of both practical and theoretical spectroscopy. The goals of this lecture series are to illustrate how spectroscopic data are obtained and reduced, define the physical processes that govern the form of astronomical spectra, and discuss the spectral diagnostics that allow us to formulate a physical picture of distant objects. The practical aspects will include types of spectrographs, considerations for planning observations and spectroscopic data analysis. The theoretical component will include causes of emission and absorption, atomic physics and discussion of the hydrogen atom and more complex molecules. We will discuss types of emission, classification of spectra and measurements made from spectra.

2) Course breakdown/syllabus:
- Introduction
- Radiation fundamentals
- Atomic structure (the hydrogen atom)
- Continuous emission
- Spectral lines
- Molecular spectroscopy
- Classification and spectral diagnostics
- Instrumentation
- Spectroscopic Data Reduction
- Spectroscopic Data Analysis

3) Resources:
Resources will be provided in the lectures.

Reading material:
- Astronomical Spectroscopy by Massey and Hanson 2011, https://arxiv.org/pdf/1010.5270.pdf
- Essential Radio Astronomy course by Condon and Ransom:
  - Radiation fundamentals: https://www.cv.nrao.edu/~sransom/web/Ch2.html
  - HI 21cm line https://www.cv.nrao.edu/course/astr534/HILine.html
- Atomic Astrophysics and Spectroscopy, A. Pradhan and S. Nahar, 2011, Cambridge University Press
- Interpreting Astronomical Spectra, D. Emerson, 1996, Willey
- Astronomical Spectroscopy, J. Tennyson, 2005, Imperial College Press
- Radiative Processes in Astrophysics, G. Rybicki and A. Lightman, 1979, Willey

4) Breakdown of practicals/tutorials:
The tutorials will include calculations and written questions related to the material covered in class and some python exercises (3 exercise sheets). The practical project will involve

spectroscopic data reduction and measurements, with a written report and brief presentation of the results. A second project will require a scientific paper to be read and reported on, with a written report and presentation in pairs.

5) Additional skills to be developed during the course:
Python programming, reading and discussing scientific material, presentation skills, scientific writing/reporting, numerical problem solving, ability to explain concepts to others in the class and to demonstrate understanding through an oral test.

6) Assessment

Class attendance and participation: 5%
1 Written class test: 25%
3 exercise/tutorial worksheets: 30%
Paper write-up and presentation: 20%
Project write-up and presentation: 20%