

Welcome to PHYS153, Astronomy Lab. This laboratory is intended to accompany the lecture course PHYS152 (Descriptive Astronomy) but may be taken at any time as a standalone one-credit course. If your objective is to fulfill ISU Goal V you must take both PHYS152 and PHYS153, though you do not have to take both at the same time.

The syllabus, FAQ, schedule, video library, policies and procedures for PHYS153 are available at: <http://www.physics.isu.edu/~hackmart/phys153.html>. The answer to virtually any question you might have about this course may be found there.

This lab manual contains all of the information you will need to complete the procedures that constitute this course. The ten procedures you will complete are performed in an order that corresponds approximately to the order of topics in the lecture course. The procedures are also more challenging as the semester progresses and your skills, knowledge and confidence increase.

This manual has several features designed to simplify your lab experience. There is no need for a lab notebook for this course as blocks in this manual have been reserved for you to record your measurements and observations. The lab manual has a number of boxes that look like this:



distributed throughout. Each of these boxes has been placed just below a question that has been posed for your consideration. Your lab instructor will evaluate your performance in the lab, in part, based on your answers to these questions.

At the end of most of the procedures there are exercises with review questions for you to answer. It is extremely important that you complete these immediately at the conclusion of each lab. Doing so will reinforce the concepts you have just learned and increase your comprehension of each lab.

Many of the procedures in this lab use computers to access sky maps, spreadsheets, graphing programs, spectral atlases, etc. Your lab instructor will show you how to access these programs as needed.

Each procedure that involves numerous (or laborious) computations is accompanied by a computer spreadsheet program. These spreadsheets are designed to relieve you of the burden of plodding through repetitive calculations so that you may, instead, concentrate on interpreting your data. The cells in these spreadsheets are locked except for the ones set up for data entry. Several of these spreadsheets produce plots based on your data. The lab computers will not permit you to save any data once you have exited a program. Be sure to print a copy of any spreadsheet or graph you produce before exiting a spreadsheet.

An example of one of these spreadsheets is shown below. The cells in dark gray (locked) contain column headings, titles or formulas that perform operations on your data. The cells in red (locked) contain example measurements included so that you may determine if your measurements

are close to the values a skilled experimenter would obtain. The cells in pale yellow (unlocked) are for data entry. The tabs along the bottom of the worksheet select other worksheets containing plots, graphs, etc. based on your data.

Calibration Data		Grating Dispersion (Å/mm):									
disp (mm)	λ (Å)		Galaxy In	e - K (mm)	e - H (mm)	$K\lambda$ (Å)	$H\lambda$ (Å)	$\Delta\lambda_K$ (Å)	$\Delta\lambda_H$ (Å)	$\Delta\lambda/\lambda$ (K)	
0.0	3889	a	Virgo	-25.1	-23	-537.14	-492.2	3934.36	3979.30	0.000	
4.4	3965	b	Ursa Major	-16.1	-14.5	-344.54	-310.3	4126.96	4161.20	0.049	
5.9	4026	c	Corona Borealis	-10.4	-9	-222.56	-192.6	4248.94	4278.90	0.080	
11.0	4144	d	Bootes	-1.4	1.1	-29.96	23.54	4441.54	4495.04	0.129	
26.6	4472	e	Hydra	11.9	14	254.66	299.6	4726.16	4771.10	0.201	
38.9	4713	f									
52.5	5016	g									
H₀ (km/sec/Mpc):						70.1	72.0 ±10%				
Age (Y):						1.40E+10					
							100%				

It is our hope that you will find much of what you learn in this lab to be interesting and useful to you outside of class. Astronomy is a field that generally elicits a good deal of excitement and native interest among students. We have endeavored to instill in these procedures a sense of history, context and wonder about the natural world. Our hope is that you will find the lab more informative and enjoyable than difficult. Best of luck.

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