

# PROGRAM-SPECIFIC COMPETENCIES - PHYSICS AND ASTRONOMY

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Competencies are the skills, knowledge and attributes gained through every work, educational, volunteer and life experience.

UVic students in the [Physics and Astronomy](#) program develop the following program specific competencies. We worked with the Department of Physics and Astronomy to develop this document.

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## PHYSICS AND ASTRONOMY KNOWLEDGE

**Develops knowledge of physical laws and principles and the use of analytical methods to analyze explain and predict the workings of the physical world**

- + Understands the fundamental physical laws and principles of diverse areas of physics including mechanics, relativity, oscillatory and wave motion, electricity and magnetism, optics, thermodynamics, quantum and particle physics, and statistical mechanics
- + Uses mathematics to describe the physical world
- + Makes explicit assumptions and approximations
- + Develops mathematical models capable of predicting outcomes or behaviours of physical systems
- + Plans, carries out, analyzes and reports the results of an experiment or investigation using appropriate analytical methods
- + Evaluates uncertainties and compares results with expected outcomes, and relates conclusions to physical models
- + Critically compares results of predictive calculations with those from experimentation or observation
- + Applies principles of physics to specific complex topics including astronomy and astrophysics, medical physics, geophysics, ocean and atmospheric physics, and solid-state physics

## SCIENTIFIC METHOD

**Understands and uses the principles of the scientific method and the application of experimental techniques to solve specific problems**

- + Uses effective literature search strategies and critically evaluates the scientific literature
- + Gathers empirical and measurable evidence through observation and experimentation
- + Analyzes data
- + Formulates a clear, answerable question
- + Uses inductive reasoning and deductive methods to develop a testable, falsifiable hypothesis and predict expected results
- + Designs quantitative approaches and experiments to test and evaluate hypothesis
- + Observes and records the results of the research
- + Uses mathematical and statistical methods and analytical tools to evaluate the data
- + Draws conclusions
- + Communicates the results and ideas in scientific reports and papers and oral presentations and/or conducts further research
- + Develops written and oral skills that enable clear and effective communication.

## COMPUTATION

### **Develops and uses scientific software to support research endeavors**

- + Creates, modifies and utilizes scientific software
- + Develops and uses computation modeling as a proxy for physical experimentation
- + Develops and uses computational methods to analyze large data sets

## FIELD WORK

### **Conducts research in the field**

- + Observes behavior, properties of subjects and phenomena of interest in situ
- + Makes measurements of the subjects, phenomena or their environment
- + Identifies and collects samples for analysis
- + Operates and uses equipment, tools and machinery appropriately

## LABORATORY WORK

### **Uses practical and safe techniques within a laboratory setting**

- + Uses safe and careful practices at all times
- + Keeps accurate laboratory records
- + Takes precise and accurate measurements and gains appreciation of potential sources of error associated with laboratory measurements
- + Trouble shoots and optimizes methods and techniques
- + Develops methods and procedures
- + Analyzes, modifies and characterizes compounds, samples or devices
- + Uses instrumentation appropriately, including maintaining, calibrating and troubleshooting equipment
- + Gains experience critically evaluating data generated

## EDUCATION AND TRAINING

### **Instructs co-workers in scientific procedure**

- + Teaches scientific concepts and knowledge at a level appropriate to the audience
- + Trains and supervises others to perform scientific and laboratory procedures