Draft: Physics & Astronomy Annual Program Plan

March 27, 2014

Canãda College Mission Statement

It is the mission of Canãda College to ensure that students from diverse backgrounds have the opportunity to achieve their educational goals by providing quality instruction in general, transfer, career, and basic skills education, and activities that foster student's personal development and academic success. Canãda College places a high priority on supportive faculty/staff/student teaching and learning relationships, responsive support services, and a co-curricular environment that contributes to personal growth and success for students. The College is committed to the students and the community to fulfill this mission.

Canãda College Vision Statement

Canãda College ensures student success through personalized, flexible, and innovative instruction. The College infuses essential skills and competencies throughout the curriculum and assesses student learning and institutional effectiveness to make continuous improvement. Canãda responds to the changing needs of the people it serves by being involved in and responsive to the community, developing new programs and partnerships and incorporating new technologies and methodologies into its programs and services.

Document Map:

1. Key Findings

- PHYSICS:
  The transfer oriented physics program continues to grow. However, more support must be developed for the entry courses PHYS 210 and PHYS 250 to improve the success rates. The presence of the STEM center and the dedicated physics tutoring within the STEM center has been a very helpful in this regard. We will continue to work closely with the STEM center to enhance and improve the supports available to the students.
- ASTRONOMY:
  There was a significant drop in "'concurrent enrollment students"' in the astronomy courses. We plan to address this through better advertisement of the astronomy courses both to current and future students. Special consideration must be made for the Middle College program to address the drop in concurrent student enrollment.

  Other immediate goals of the astronomy program are as follows:

  – Aligning Astronomy 100 course content to provide better conceptual foundation for the Astronomy 101 labs.
  – Development of updated or new astronomy 101 laboratory exercises that support student skill learning and align with astronomy 100 course content.
  – Acquisition of updated or new equipment for use in astronomy 100 demonstrations and class work, and in astronomy 101 exercises (see list in section 8.3 below).
  – Request for facilities for a more permanent mount of existing telescopes to better stream observations for astronomy 101 labs (see section 8.5 below).

2. Planning Group

Martin Partlan & Attila Elteto

3. Writing Team

Martin Partlan & Attila Elteto

4. Program Information

3.1 Program Personal

Full Time Faculty	
Martin Partlan Ph.D.	Physics
Attila Elteto Ph.D.	Astronomy
Adjunct Faculty	
Jeanne Digel Ph.D.	Physics & Astronomy
Akilles Speliotopoulos Ph.D.	Physics
Gabriel Prochter	Astronomy
Classified Staff	
Roslind Young	Physical Sciences Lab Technician
Justine Walsh	Physical Sciences Lab Technician

3.2 Program Mission and Vision

The Physics & Astronomy Department endeavors to prepare students for successful transfer to four-year institutions, to provide the prerequisite foundation in physical sciences for further work in engineering and the sciences, to foster critical thinking and active learning, and to fulfill the needs and interests of students by having a well rounded curriculum of lecture and laboratories.

3.3 Program Student Learning Outcomes

Program Student Learning Outcome	Means of Assessment	Results
The Scientific Method - Students completing this program will be able to use the scientific method and appreciate its importance to the development of scientific thought	An observational research project, Success criterion - 75% of students who complete the observational research project will correctly identify, collect and analyze relevant data	Significantly better than 75%
Effective Communication and Documentation of Work - Students completing this program will demonstrate the ability to document and communicate their work effectively	Portfolio - Students will submit a portfolio of laboratory work conducted throughout the semester Success criterion - The average grade of students who completed the portfolio is 70% or above Or: Laboratory reports - Success criterion - Students who completed all laboratory reports scored an average grade of 75% or higher	 Significantly better than 75%
Critical Thinking and Analysis of Physical Systems - Students completing this program will demonstrate critical thinking and the ability to analyze physical systems in terms of scientific concepts	Embedded questions on the final exam Success criterion - 70% of students answer the selected question(s) correctly	Better than 70%

These program SLO's are supported by the course level SLO's shown in subsections below.

5. Response to Previous Program Plan & Review

The Comprehensive Program Review for the physical Sciences Department was completed in Spring 2012. The only feedback from the Spring 2013 Annual Program Plan was that we should do more analysis of our program SLO's. We have included that in this APP, see Section 3.3.

6. Curricular Offerings

5.1 TracDat and Curriculum Data

5.1.1 *Physics/Astronomy Student Learning Outcomes Assessment*

The following list contains all of the physics student learning outcomes, Data for student learning outcomes has been collected since 2009.

- Physics 114
    1. Interpret the meaning of the chemical equation and relate it to the physical materials involved in the process.
    2. Carry out a chemical experiment to test a hypothesis and critically analyze the results.
    3. Describe energy in forms important to systems in physics and chemistry.
    4. Describe the fundamental forces that hold an atom together, and its role in chemical bonding.
    5. Critically evaluate scientific information in the popular press.
- Physics 210
    1. Perform an analysis of a physical system in terms of forces, velocities displacements and accelerations and time using Newton's laws
    2. Analyze the motion of a body (rotational or linear) in terms or momentum, kinetic energy, and potential energy
    3. Perform an analysis of isobaric, isochoric, isothermal and adiabatic processes in their relation to work, heat transfer, and changes in internal energy
- Physics 211
    1. Describe and Calculate kinematic variables as derivatives and integrals
    2. Use integrals to calculate work by a varying force
    3. Use differential equations to analyze simple the harmonic motion of a mass on a spring
- Physics 220
    1. Analyze and explain the behavior of simple DC circuits with resistors, capacitors, and batteries
    2. Analyze the reflection and refraction of light in terms of geometrical optics in different media
    3. Describe the photo-electric effect, the Compton effect, quantization of energy and the Bohr model of the atom
- Physics 221
    1. Use surface integrals and Gauss' law to obtain the electric field for symmetric charge distributions
    2. Use line integrals and Ampere's law to obtain magnetic fields
    3. Use differential equations to analyze RLC circuits
- Physics 250
    1. Perform an analysis of a physical system in terms of forces, velocities displacements and accelerations and time using Newton's laws
    2. Analyze the motion of a body (rotational or linear) in terms or momentum, kinetic energy, and potential energy
    3. Setup, perform, analyze, and document an experiment. Evaluation is based on the submitted laboratory reports
- Physics 260
    1. Analyze electric forces and fields created by a system of charged particles
    2. Analyze and explain the behavior of simple AC and DC circuits with resistors, capacitors, and inductors
    3. Solve problems involving induced electric and magnetic fields
- Physics 270
    1. Perform an analysis of isobaric, isochoric, isothermal and adiabatic processes in their relation to work, heat transfer, and changes in internal energy
    2. Analyze the reflection and refraction of light in terms of geometrical optics in different media
    3. Explain the principle assumptions of Special Relativity and able to perform calculations involving relativistic kinematics

4. Describe the photo-electric effect, the Compton effect, quantization of energy and the Bohr model of the atom

- Physics 405
    1. Identify and distinguish electromagnetic radiations in terms of properties of frequency, wavelength, and energy
    2. State the principles of electromagnetic induction and apply them to the x-ray circuit
    3. Identify the factors that affect the x-ray emission spectrum and explain what effect these factors have on the emission spectrum
- ASTR 100 (Updated 3/27/2014)
    1. Identify and describe the formation and characteristics of the planets, the properties and evolution of stars, and the structure of the Milky Way galaxy
    2. Demonstrate their understanding of the scientific process by describing how astronomical observations are used to support scientific theories
    3. Demonstrate their astronomical and scientific communication skills through the collection, analysis, and reporting of data
- ASTR 101 (Updated 3/27/2014)
    1. Construct and analyze models, simulations, and other representations of astronomical concepts
    2. Demonstrate their understanding of the nature of light and of telescopes through laboratory exercises and reports
    3. Demonstrate scientific communication skills through clear, well-organized laboratory and project reports, as well as oral presentations

5.1.2 *Physics/Astronomy SLO Results*

The following table summarizes the Physics/Astronomy SLO results and schedule. SLO results are aggregated from students that passed the course.

Institutional Learning Outcome #4 is:
"Represent complex data in various mathematical forms (e.g., equations, graphs, diagrams, tables, and words) and analyze these data to make judgments and draw appropriate conclusions."

Physics & Astronomy SLO Results & Schedule

Course	SLO	ILO	2012-13		2013-14		2014-15		2015-16		2016-17	
			Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
PHYS 210	1	4	73%								S	
	2	4	88%				S					
	3	4	86%						S			
PHYS 211	1	4	85%								S	
	2	4	85%				S					
	3	4			82%				S			
PHYS 220	1	4		84%								S
	2	4		87%				S				
	3	4		80%						S		
PHYS 221	1	4		90%								S
	2	4		93%				S				
	3	4		80%						S		
PHYS 250	1	4		74%		S						
	2	4		77%				S				
	3	4		90%						S		
PHYS 260	1	4			81%		S					
	2	4			75%				S			
	3	4			72%						S	
PHYS 270	1	4		71%		S						
	2	4		85%		S						
	3	4		78%				S				
	4	4		83%				S				
PHYS 405	1			74%			S					
	2			79%			S					
	3			60%		75%			S			
ASTR 100	1*	4					S					
	2*	4						S				
	3*	4	75%						S			
ASTR 101	1*	4					S					
	2*	4						S				
	3*	4							S			

* ASTR SLO's were revised in Spring 2014

S- indicates scheduled for assessment

5.2 Identify Patterns of Curriculum Offerings

The following tables contain the physical science courses, the latest Course Outline of Record (COR) date.

Physics & Astronomy Curriculum

Course	Name	Latest COR Date
PHYS 114	Survey of Chemistry and Physics	2/2014
PHYS 405	Rad tech Physics	3/14/2014
PHYS 210	General Physics I	3/14/2014
PHYS 211	General Physics I Calculus Supplement	5/11/2009
PHYS 220	General Physics II	3/14/2014
PHYS 221	General Physics II Calculus Supplement	5/11/2009
PHYS 250	General Physics I w/Calculus	3/14/2014
PHYS 260	General Physics II w/Calculus	3/28/2014
PHYS 270	General Physics III w/Calculus	3/14/2014
ASTR 100	Introduction to Astronomy	2/24/2012
ASTR 101	Introduction to Astronomy	2/24/2012

At the time of this writing, PHYS 211, 221 and ASTR 100, 101 are being revised

Physics & Astronomy Course Offerings

Course	2012-13			2013-14			2014-15		
	Fall	Spring	Summer	Fall	Spring	Summer	Spring	Fall	Summer
PHYS 210	4			3					
PHYS 211	1			1					
PHYS 220		3			2				
PHYS 221		1			1				
PHYS 250	2	2		3‡	3				
PHYS 260	1	1	1	1	2‡				
PHYS 270		1			1				
PHYS 405	1			1					
ATSR 100	3†	3†	1†	2†	3†				
ASTR 101	2†	2†	1†	1†	3†				

† Hybrid sections available

‡ Honors sections available

In general curricular offerings are consistent with demand. We continue to experiment with adding additional sections of PHYS 210 and 250 and ASTR 100/101 to see if there is enough un-met need for additional sections.

6. Program Level Data

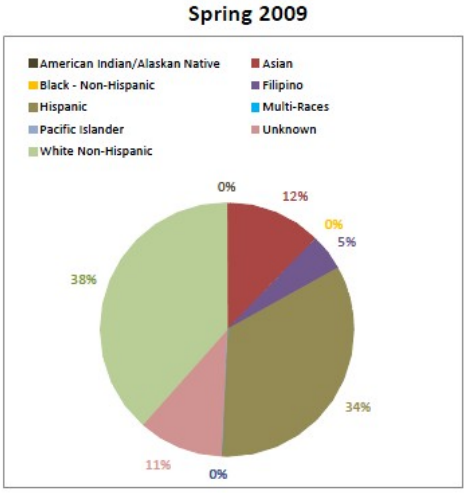
6.1 Data Packets and Analysis from the Office of Planning, Research & Student Success and any other relevant data.

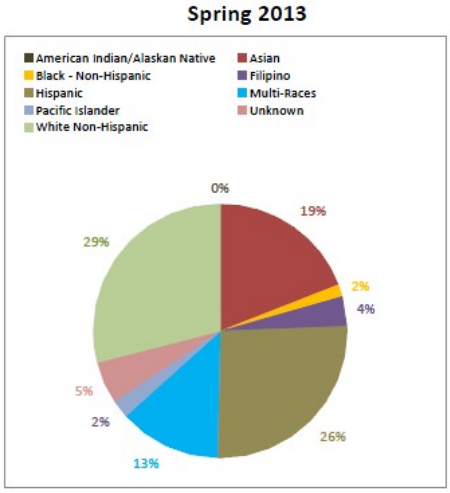
6.1.1 Physics

Findings:

- Physics course enrollments are up, Spring 2013-135 up from Spring 2009-60. Demand has been matched with an increased number of section offerings. Physics courses have a high fill rate, 19/24 possible or about 79%.
- FTES are up, Spring 2013-27.1 up from Spring 2009-17.1.
- There was an overall increase in the percentage of transfer student enrollment. Spring 2013-74% up from Spring 2009-54%.
- Student demographics in physics are now much closer aligned with college demographics overall except that there is a higher proportion of Asian students, 19% Physics vs. 8% College
- The proportion of male and female students remained steady between 2009 and 2013 around 75-25% each. Compared to the college average, the proportion of female students enrolled in physics remained much lower in every year.

		Term				
Department	Metric	Spring 2009	Spring 2010	Spring 2011	Spring 2012	Spring 2013
PHYS	Transfer (w/ or w/o Degree)	35	52	67	85	97
	Career Dev (Degree, Certificate, License)	1	6	8	13	8
	Educational Development	7	5	4	4	9
	4 Yr College Student attending Cañada	20	19	20	9	10
	Undecided on Goal	1	4	2	3	7
	% Transfer (w/ or w/o Degree)	54%	60%	66%	75%	74%
	% Career Dev (Degree, Certificate, License)	2%	7%	8%	11%	6%
	% Educational Development	11%	6%	4%	4%	7%
	% 4 Yr College Student attending Cañada	31%	22%	20%	8%	8%
	% Undecided on Goal	2%	5%	2%	3%	5%



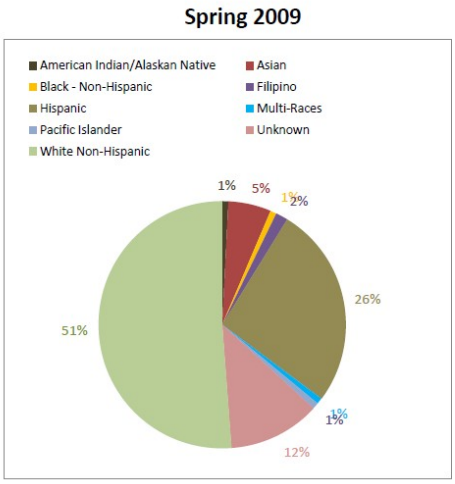


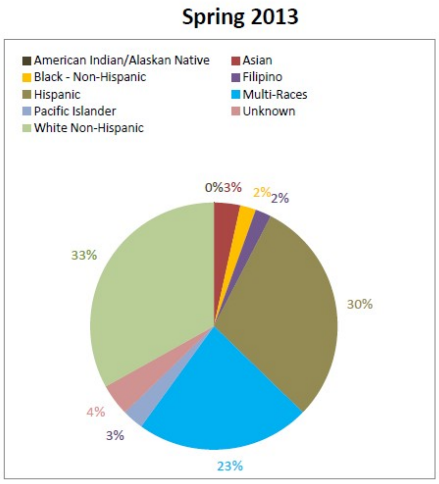
6.1.2 Astronomy

Findings:

- There is a general downward trend in LOAD probably due to the increased number of section offerings.
- There was a significant drop in concurrent student enrollment in astronomy between the span of 2009-2011 and 2012-2013. The drop is much greater than that observed for the college overall.
- There was an overall increase in the percentage of transfer student enrollment. The trend is similar to the one observed for the college. The proportion of transfer students enrolled in astronomy was significantly higher than the college average in every year.
- There was a significant change in ethnic demographics between 2009 and 2013. Student demographics in astronomy are now much closer aligned with college demographics overall.
- The proportion of male and female students remained steady between 2009 and 2013 around 50-50% each. Compared to the college average, the proportion of female students enrolled in astronomy remained much lower in every year.
- The age demographics of students in astronomy remained fairly steady over the period of 2009-2013. Compared to the college average, the astronomy student demographics has much higher percentage representation of younger students in the 18-19 and 20-24 year old categories. This is correlated with the high percentage of transfer students found previously.

Department	Metric	Term				
		Spring 2009	Spring 2010	Spring 2011	Spring 2012	Spring 2013
ASTR	First-Time Student	11	4	5	9	11
	Continuing Student	89	116	103	142	116
	Returning Student	11	11	4	15	13
	Concurrent Enrollment	14	16	26	4	5
	Percent First Time	9%	3%	4%	5%	8%
	Percent Continuing	71%	79%	75%	84%	80%
	Percent Returning	9%	7%	3%	9%	9%
	Percent Concurrent	11%	11%	19%	2%	3%





7. Action Plan

7.1 Physics

Student success in the entry courses PHYS 210 and PHYS 250 continues to be a problem. About 50% of the students in these courses seem to not be ready for the work-load that these courses demand. Consequently theses students get behind, get frustrated and drop/fail. The department has tried a diagnostic pre-tests in the past to see if we could determine who is ready physics and who is not. The results were inconclusive, some students who seemed not likely to pass rose to the challenge while others who should have done fine did not succeed. This seems to suggest that the key element in student success is motivation.

We will continue to work closely with the STEM Center and the Physics tutor center to support the motivated but unprepared student.

- Continue with SLOAC at the course and program level.
- Improve student learning outcomes
- Continue to develop auxiliary physics tutoring to help improve student success in PHYS 210 and PHYS 250

7.2 Astronomy

Similar to physics, student success in astronomy greatly suffers from many students lacking necessary learning skills and unprepared for college-level work. Significant effort is spent in our courses just bringing students up on their literacy and writing skills, and hence less time is available to foster the scientific thought process and skills our courses are meant to teach. In order to maximize student learning of science, and reinforce the content and skills taught in these courses, a closer alignment between ASTR 100 and 101 is to be explored. Students have expressed a need for tutoring services in astronomy. Such service is also warranted by the lag in learning skills alluded to above. We'll recommend students to the Learning Center, to provide such services, who have excelled in ASTR 100, and who have demonstrated good interactive skills with other students. There are significant deficiencies in the equipment available to astronomy. The available telescopes are difficult to set up/use. A lot of other equipment needs to be borrowed from physics or Earth sciences. Astronomy is working on updating its inventory (see sections 8.3 & 8.5 below). Review of student data (see section 6.1.2 above). has verified a continued need for the current sections of astronomy courses offered. It has also identified a drop in concurrent student enrollment. The cause for this drop has yet to be identified and mitigated.

- Align ASTR 100 course content to provide better conceptual foundation for the ASTR 101 labs.
- Develop updated or new ASTR 101 laboratory exercises that support student skill learning and align with ASTR 100 course content.
- Acquire updated or new equipment for use in ASTR 100 demonstrations and class work, and in ASTR 101 exercises (see section 8.3 below).
- Request facilities for a more permanent mount of existing telescopes to better stream observations for ASTR 101 labs (see section 8.5 below).
- Increase student enrollment in all sections of astronomy through better advertisement of the astronomy courses both to current and future students. Special consideration must be made for the Middle College program to address the drop in concurrent student enrollment.
- Recommend excellent astronomy students as future astronomy tutors in the Learning Center.

8. Resource Identification

8.1 Faculty and Staff Hiring Requests

- The STEM Center with the physics tutoring service and supplemental instruction is an extremely valuable asset. Request that this be maintained and expanded it possible. This is a tremendous help to the under-prepared and first-time college students as well as returning veterans.
- Astronomy students have expressed a need for tutors for astronomy classes. As of the spring semester, 2014, no such service is available on campus. It is requested that the Learning Center work with astronomy faculty to help identify, recruit, and support students who have demonstrated excellence in astronomy classes to offer tutoring services starting in 2014.

8.2 Professional Development Needs

None at this time

8.3 Classroom & Instructional Equipment Requests

The following instructional equipment is requested:

Item description	Cost per unit	Units requested	Total Cost	Vendor
Request 2013				
Pasco Xplorer PS-2002	$359	8	$2872	PASCO PS-2002
High sensitivity light sensor PS-2176	$159	8	$1272	PASCO PS-2176
Magnetic Field Sensor PS-2112	$60	8	$480	PASCO PS-2112
Gas discharge Tube Argon	$40	12	$480	CENCO WLS68755-30A
Gas discharge Tube Helium	$40	12	$48	CENCO WLS68755-30F
Gas discharge Tube Hydrogen	$40	12	$480	CENCO WLS68755-30G
Gas discharge Tube Mercury	$55	12	$660	CENCO WLS68755-30K
Gas discharge Tube Neon	$40	12	$480	CENCO WLS68755-30L
CENCO Spectrum Tube Power Supply	$216.15	10	$2162	CENCO WL2393D
Request 2014				
Pasco Optics Kit OS-8546B	$1064	10	$10640	PASCO OS-8546B
Pasco Lens Plus Set SE-7578	$265	10	$2650	PASCO SE-7578
Pasco Electroscope SF-9069	$225	5	$1125	PASCO SF-9069
Pasco Discover Charge Set ES-8086	$21	16	$336	PASCO ES-8086
Pasco Electrostatic SF-9068	$59	10	$590	PASCO ES-9068
Pasco RLC Circuit CI-6512	$129	2	$258	PASCO CI-6512
Pasco GLX power amp EX-9967	$455	8	$3640	PASCO EX-9967
Meade Star Navigator 130mm Reflecting Telescope with AudioStar, Item # 20130	$400	4	$1600	Meade
Orion 20*x*80 Astronomical Binocular &XHD Tripod Bundle	$250	2	$500	Telescope.com
Edu Science World Globe 12 inch Diameter Globemaster	$27	12	$324	toyrus.com
Astronomy posters	$20	5	$100	allposters.com
SkyShed POD Dome	Est. $3000	1	Est. $3000	skyshedpod.com
SkyShed POD Pier	Est. $1000	1	Est. $1000	skyshedpod.com
Celestron telescope moon filter, 1.25 inch	$17	1	$17	Telescopes.com
Zhummel optic cleaning kit	$13	2	$26	Zhummel
Iron meteorite	Est. $250	1	Est. $250	meteoritemarket.com
Chondrite meteorite	Est. $70	1	Est. $70	meteoritemarket.com
Updated laptops or tablets for physics lab (does note need to be new)	unk	12	unk	unk

8.4 Office of Planning, Research & Student Success Requests

None at this time

8.5 Facilities Requests

- A new building with:
  - more and better lab space
  - large lecture rooms
  - roof top observatory
  - updated projectors with dual scree capability
  - enlarged STEM Center facilities
  - group study areas
- SkyShed POD Dome and Pier (total estimated cost: $4000, see section 8.3) for the 16” Meade telescope for permanent set-up. Also requested is an accessible space, enclosure, or rooftop for this Dome set up.