



ONLINE SENIOR ASTRONOMY COURSE

2015 Enrolments



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PREAMBLE

Astronomy education encapsulates a broad context of science that continues to challenge our way of understanding and processes of thinking. Astronomy is an exciting visual science that stirs up scientific curiosity in young people that involves nearly the whole range of the physical sciences, including mathematics, physics, chemistry, geology and engineering and computer science.

Our astronomy education program was first established in 2004 as a direct result of the Queensland Government's 'Spotlight on Science' initiative to promote STEM education in Queensland. We believe it effectively addresses this agenda by providing exciting and digitally-rich educational opportunities for students to engage in full, real-life learning whilst applying skill sets learned in mathematics and physics to synthesise, generalise, explain and hypothesise observed phenomenon outside of our atmosphere. These higher-order thinking operations, inherent in the nature of the topic, transform students from passive learners of knowledge to that of producers of knowledge.

Students will learn how to quantitatively model and apply the laws of physics to a wide range of astronomy related topics which will empower them as rational and creative thinkers, engaging them in the acquisition of knowledge and the development and understanding of the physical aspects of astronomy through active processes of scientific investigation and research.

Online Senior Astronomy is a one-year course registered as a Recognised School-based Subject by the Queensland Curriculum & Assessment Authority (QCAA) and contributes credit towards the Queensland Certificate of Education for Queensland students. It has been developed through extensive consultation with senior lecturers in the Mathematics, Physics and Astronomy departments at James Cook University (JCU) in Townsville. Other contributing institutions include the University of Southern Queensland - Toowoomba, Swinburne University of Technology and Monash University - Melbourne, University of California, Berkley and Gettysburg College (USA) and CSIRO's Australian Telescope National Facility (ATNF).

Students who study Senior Astronomy online can enjoy direct contact with professional academics and astronomers from astronomical institutions world-wide.

COURSE DELIVERY

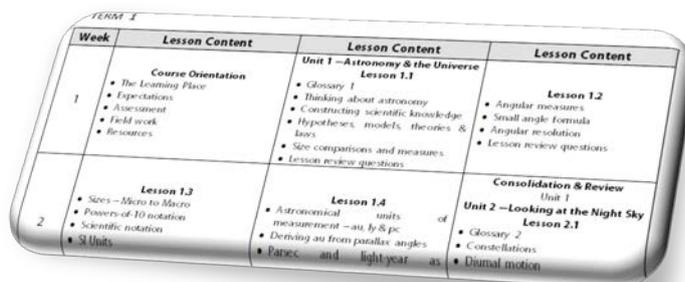
COURSE PRE-REQUISITES

Senior Astronomy is recommended for Yr 11 students who have achieved high grades in Yr 10 mathematics (advanced) and science. It is desirable for students to be studying Mathematics B (QLD) or equivalent and Senior Physics concurrently with Senior Astronomy. The course can be delivered to talented Yr 10 students as an accelerated curriculum option for mathematics and science.

COURSE DURATION

The course has been designed to run over one full school year, equivalent to one high school subject. This equates to three 70 minute lessons per week over 40 weeks (110 hrs of instruction and assessment). However, due to the nature of the online delivery, the course can be self-paced to suit students' circumstances.

For high school students however, we recommend that the course be completed in the year intended for study. A work-rate schedule is issued to students to assist them in keeping on-track to finish in one year.



Week	Lesson Content	Lesson Content	Lesson Content
1	Course Orientation <ul style="list-style-type: none"> The Learning Place Expectations Assessment Field work Resources 	Unit 1 – Astronomy & the Universe Lesson 1.1 <ul style="list-style-type: none"> Glossary 1 Thinking about astronomy Constructing scientific knowledge Hypotheses, models, theories & laws Size comparisons and measures Lesson review questions 	Lesson 1.2 <ul style="list-style-type: none"> Angular measures Small angle formula Angular resolution Lesson review questions
2	Lesson 1.3 <ul style="list-style-type: none"> Sizes – Micro to Macro Powers-of-10 notation Scientific notation SI Units 	Lesson 1.4 <ul style="list-style-type: none"> Astronomical units of measurement – au, ly & pc Deriving au from parallax angles Parsec and light year as 	Consolidation & Review Unit 1 Unit 2 – Looking at the Night Sky Lesson 2.1 <ul style="list-style-type: none"> Glossary 2 Constellations Diurnal motion

COURSE UNITS AND ASSESSMENT

The Senior Astronomy online course is made up of 9 units. The first three are introductory units:

- Unit 1 – Astronomy and the Universe
- Unit 2 – Observational Astronomy
- Unit 3 – Eclipses
 - *Simulation and online report – Transit of Venus and Mercury*
- Unit 4 – Dynamics of the Solar System (Introduction to Kinematics)
 - *Two-part supervised examination – Units 1 to 4*
- Unit 5 – Properties of Light
 - *Simulation and online exercises – Spectral Analysis*
- Unit 6 – Rotational Mechanics
 - *Two-part supervised examination – Units 5 & 6*
- Unit 7 – Optics and Telescopes
- Unit 8 – Planetology
 - *Research activity – Comparative Essay*
- Unit 9 – Solar Astronomy
 - *Simulation and online exercises – Solar Rotation & Energy Flow*



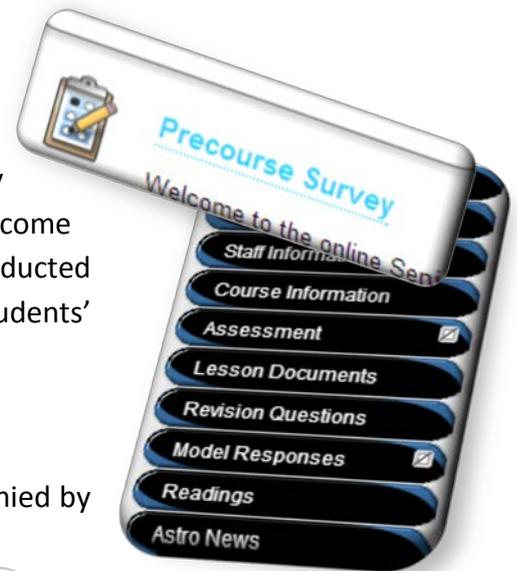
ONLINE PLATFORM

The course is delivered through Blackboard (Bb) via the 'Learning Place' which is the Queensland Government's Department of Education, Training and Employment's (DETE) secure 'eLearning' environment. Students do not need to live in Queensland to gain access to the Learning Place. We apply to have National and International students granted access to the Learning Place upon enrolment into the online Senior Astronomy course.

COURSE STRUCTURE

SURVEYS

Students start at the beginning of Unit 1 under the 'Lesson Documents' tab. Each student will need to complete a survey (setting personal goals) before the first lesson's documents become available for them to start work on. Surveys are also conducted midway and at the end of the course to best help us cater to students' needs.



LESSON DOCUMENTS

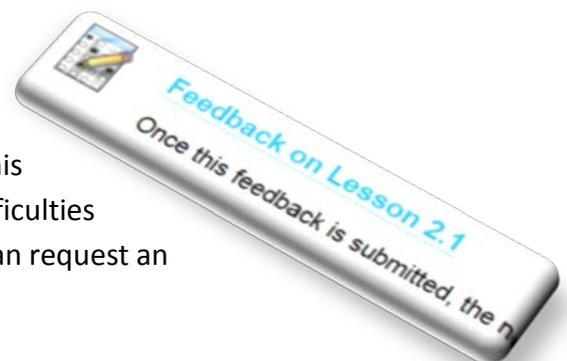
Each lesson consists of an interactive PDF document accompanied by a PowerPoint to consolidate lesson objectives.

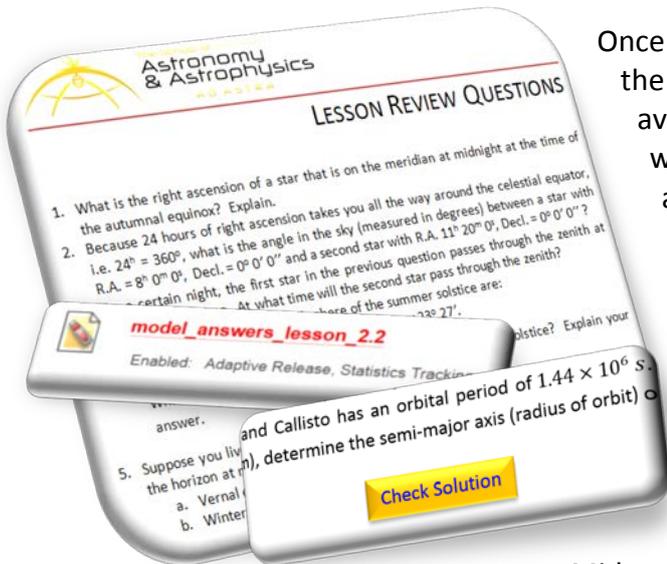


Lesson documents also have a hyperlinked "Glossary of Terms" which is maintained by professional astronomers.

LESSON FEEDBACK & REQUEST FOR ASSISTANCE

After working through each lesson, students submit a quick and easy feedback response to their instructor online. This feedback lets the instructor know if a student has had any difficulties with the lesson content. By the click of a button, students can request an instructor contact them for further assistance.

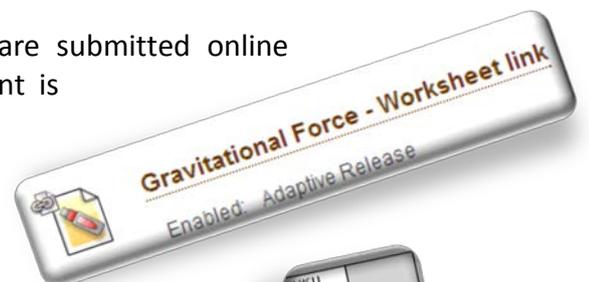




Once the lesson feedback response has been submitted, the next lesson's documents automatically become available. This functionality ensures that the student works through the course in the intended manner and not be tempted to "jump ahead" and become distracted by course content in other units.

Students receive 'instant' feedback through fully-worked model responses which appear immediately after they submit their lesson feedback. Fully worked solutions are also available for all exercise questions embedded with each lesson.

Mid-unit quizzes are submitted online and used as a tool to gauge how successfully the student is progressing through each unit. Course links to numerous topic-related worksheets and revision also become available as the relevant content is covered. This gives the student additional guided practice with the aid of fully worked solutions.



ASSESSMENT

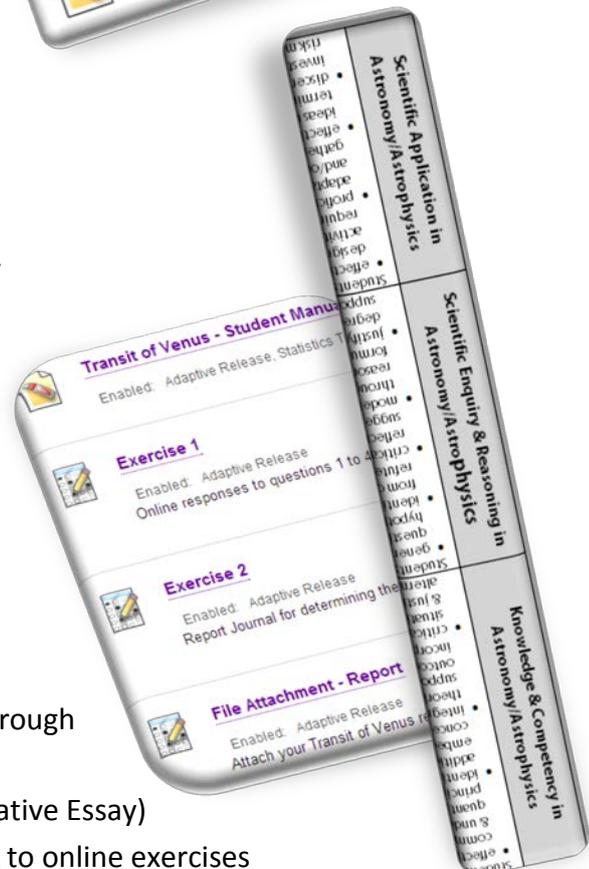
KEY AREAS OF ASSESSMENT

The student is assessed in three key areas – Application of Knowledge, Research and Investigation and Instrument and Field-work. These fall under three Standard Descriptors:

- Knowledge & Competency (KC)
- Scientific Enquiry & Reasoning (SER)
- Scientific Applications (SA)

ASSESSMENT TYPES

- Supervised Assessment (Examinations)
- Practical (hands-on) setting up of equipment through opportunities such as field trips
- Research and Scientific Report Writing (Incl. comparative Essay)
- Computer Simulations – brief report and responding to online exercises



The student is directed to revision files once they have reached the point in the course when assessment is drawing near.

QUALITY ASSURANCE & CREDIT

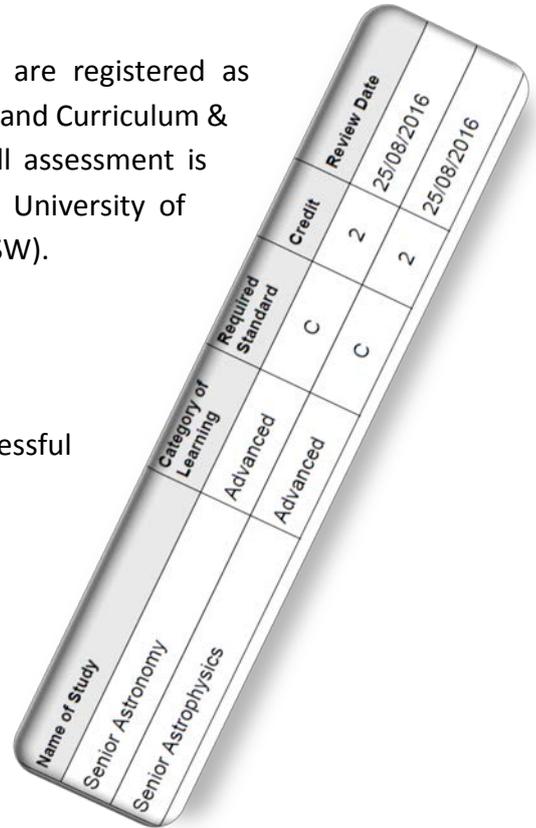
QCAA RECOGNISED STUDIES

The online courses that are offered through the school are registered as 'Recognised Advanced School-based Studies' by the Queensland Curriculum & Assessment Authority (QCAA) and are quality assured. All assessment is externally moderated by professional astronomers at the University of Southern Queensland (QLD) and Charles Sturt University (NSW).

TERTIARY RECOGNITION AND CREDIT

Queensland students will be eligible for 2 credits towards their Queensland Certificate of Education (QCE) on the successful completion of the course.

The school is currently in negotiations with universities to have our online courses recognised as tertiary credit for first-year science subjects in an undergraduate degree, with possible direct entry to the university. All successful students will be issued with a certificate of completion from the school.



Name of Study	Category of Learning	Required Standard	Credit	Review Date
Senior Astronomy	Advanced	C	2	25/08/2016
Senior Astrophysics	Advanced	C	2	25/08/2016

FIELD TRIPS AND EDUCATIONAL CONFERENCES

Each year we collaborate with our partner universities to organise week-long astronomy education conferences and field trips. This is a great way for students to meet and network with academics and other like-minded students.

The 2015 Annual Astro Conference will be held early in Term 2.

A tentative program at present looks like:

- Day 1 – UQ (St Lucia)
- Day 2 – QUT & Brisbane Planetarium
- Day 3 – 5 USQ Toowoomba & Mt Kent observatory (3-day use of USQ's 3 research telescopes including solar observations).



Opportunities to attend minor field trips may be on offer from time-to-time where students will have a chance to set up equipment at specific locations e.g. occultations.

ACCESS TO TELESCOPES

ROBOTIC HOU TELESCOPE

In recognition of the school's commitment to quality astronomy education, the University of California, Berkeley USA, gifted us a robotic 14" Schmidt-Cassegrain optical telescope on behalf of the Hands-On Universe project. James Cook University Townsville also donated a dome in which to house the telescope, along with a smaller enclosure for our 90 mm (3.5") solar refractor. Both telescopes will be operated by students via computers on-campus in a control room within our nearby auditorium.



By 2015, we hope to have the telescope in full robotic operation for students across the globe to access via the internet. We also plan to have a 152 mm (6") dedicated solar refractor available to access data in H-Alpha, white light and Ca II k-line.

Through our partnership with USQ Toowoomba, we also have access to their robotic telescopes at Mt Kent Observatory.

SOLAR IMAGING



Capt. Ralph Smith is an accomplished solar photographer and imager whose work has been acknowledged by some of the world's leading solar physicists. Ralph is working with the school to develop online tutorials on how to capture and process images of the Sun in H-alpha, white light and Calcium II k-line.

Ralph has had great success in teaching our Senior Astronomy students how to image the Sun to a standard NASA would be proud of!

(Ralph took this back-drop image through his solar telescope from his backyard in Cairns)

COMMENTS FROM PAST STUDENTS

"After studying the senior astronomy course in grade 10, the transition into senior Maths B and Physics was not as difficult as I expected and there was a vast difference in how other students were coping with the advancement in content and heavier workload. The subject also enriched my modelling and problem solving skills, especially in physics-related questions, but has been just as useful in understanding other procedures involved in advanced mathematics through an effective extension of all areas of maths as astronomy combines many aspects and actually puts them into practice.

The opportunities that have been presented to those who have taken the Astronomy and Astrophysics subjects have been once in a lifetime experiences. For example, we had the opportunity to take a field trip into outback FNQ and research the optimum location for viewing the total solar eclipse in November 2012 as well as the chance to travel to Charters Towers and be a part of aligning Blackheath and Thornburgh College's telescope. The courses have also provided the opportunity to work with professional astronomers. We had the pleasure of working with the former Director of Astronomy at JCU Townsville on a number of occasions.

I've thoroughly enjoyed my two years studying the Senior Astronomy and Astrophysics subjects while at Atherton SHS and have certainly reaped the benefits in all of my maths and science subjects. I would recommend the course to anyone with a strong interest in maths and science, especially if they are interested in extending their knowledge and learning advanced maths and science skills."



James Sellars - Current 2nd Year Medical Student, JCU Townsville.

"The school of Astronomy and Astrophysics is really fantastic. It's opened my eyes to brilliant concepts that I couldn't have dreamed of seeing anywhere else other than university, and I haven't even begun to study the Astrophysics course yet! Personally I've always been interested in astronomy; but the layout of this course has probed my curiosity further. The online style allows for a 'work at your own rate', which is great because you're not smothered by information and turned off by the topic (How I feel with almost all of my school-based subjects).

In the past few weeks I've come to realise the true value of this course. It's drastically helped me with my other three mathematics-based subjects (Maths B/C, Physics and in some parts Chemistry) and it will definitely broaden my horizon for the future. I totally recommend these courses to others who have an interest in science and are serious about strengthening their mathematical skills."



Elliot Coupe – Current Yr 12 Senior Astrophysics (Advanced) - Cairns SHS

PROFESSIONAL EXPERIENCE

Each year, students will have an opportunity to apply for “Professional Experience” placements at any of our partnering institutions. Below are brief accounts from two ‘Senior Astrophysics’ students who took up this opportunity with two of our partnering universities during 2014.

EXTRAGALACTIC EXPERIENCE - DISTANCE NOT AN OBSTACLE FOR GRACE

GRACE LAWRENCE – SENIOR ASTROPHYSICS STUDENT

Most students use rulers, tape measures or even data-loggers to measure distances in their everyday day lives, but Senior Astrophysics student Grace Lawrence prefers to use a measuring device not too many of us are aware of; or even heard of – Cepheids! Cepheid variable stars are extremely luminous stars that “pulsate” over a period of several days. There is a fascinating relationship between the star’s ‘luminosity’ and ‘pulsation period’ which allows astrophysicists to use some handy



mathematical methods to determine their distance from us, and hence the distance to the galaxy they are in. Grace was introduced to this unique method at the Australian National University’s “Research School of Astronomy and Astrophysics” (ANU-RSAA) after being selected as one of only two students that would be given the opportunity to work alongside RSAA professional astrophysicists and PhD students as part of their mid-year professional experience program.

For 5 days, Grace had the opportunity to work with some of the latest data captured by the Hubble Space Telescope (HST) from a galaxy known as Messier 82 (NGC 3034), or commonly referred to as the Cigar galaxy, somewhere in the vicinity of 12 million light-years distant. After becoming familiar with the data, Grace identified various Cepheids and used mathematical and error analysis methods to predict the distance to galaxy M82 – a task performed by just two other professionals before her.

After delivering a ‘daunting’ presentation of her findings to a host of RSAA and visiting astrophysicists on her final day, Grace was relieved to learn that her distance prediction was thought to be extraordinarily close.

Other highlights of the week for Grace were eating pizza with Prof Brian Schmidt, attending a supernova tea, attending colloquiums to hear specialists explain their cutting-edge research and learning how to carry out professional research. Grace would particularly like to thank Dr Brad Tucker for all of his professional assistance and to all of the RSAA staff who made her feel very welcome.

PROFESSIONAL EXPERIENCE

LOOKING AT A CAREER THROUGH A GRAVITATIONAL LENS

CHRIS DILGER – SENIOR ASTROPHYSICS STUDENT

Top ranking Yr 11 Astrophysics student Chris Dilger witnessed a unique insight into the fascinating realms of Quasars, Black holes, Gravitational Micro-lensing and Early Type Dwarf Galaxies through a professional work placement offered to him by Swinburne University of Technology's Centre for Astrophysics and Supercomputing in Melbourne last term. Chris was one of a handful of students to be offered this unique opportunity to work alongside world-class astrophysicists, and it wasn't long before the Assoc. Professor Chris Fluke had set him to work on his first project.

In one week, Chris attended a crash course in Cosmological Gravitational Micro Lensing, used university research tools to cite specific data in gravitational lensing models, attended the Director's lunch with a presentation on work relating to lossy compression of data cubes, explored techniques for time management in 3D modelling, attended a talk on Early Type Dwarf Galaxies, used subdivision modelling techniques and created a PowerPoint presentation to explain magnification maps as an additional resource for the GERLUMPH (magnification mapping) project.

Chris would like to sincerely acknowledge his appreciation towards Assoc. Prof Chris Fluke, Swinburne's media production crew and researcher Dany Vohl for this highly inspiring and unforgettable experience.



COURSE FEES AND ENROLMENTS

COURSE COST PER STUDENT:

QLD State School - \$450

Non-Gov. and Interstate - \$500

International - \$700

COURSE INSTRUCTOR AND HEAD OF SCHOOL

Mr David Platz

Email: dplat4@eq.edu.au

WEBISTE

You can visit our website at:

<https://learnastro.eq.edu.au>



ENQUIRIES & ENROLMENTS

For general enquires and enrolment forms, please contact the school:

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OTHER ONLINE COURSES AVAILABLE:

Senior Physics, Senior Astrophysics and Senior Astrophysics (Advanced).