Stargazey Pie!

A slice of Highlands astronomical life!

Tues 1st Nov 2011

INTRODUCTION

- **2011-12 Programme Update - Dates For Your Diary.**

  Special Event – Caroline Smith, Curator of the Natural History Museum, London will give a talk about meteorites on Thursday 17th November at 19:30 at Inverness Royal Academy. There is no charge for this. All members of HAS and the public are welcome.

  Saturday 3rd December - HAS Christmas Dinner at 19:00 for 19:30 at the Beaufort Hotel, 11 Culduthel Road, Inverness IV2 4AG. Tel. 01463 222897. Cost is £25.00 per person inclusive of tip. If you have signed up please ensure that you have paid in full by Monday 14th November. Cheques are to be made out to "Highlands Astronomical Society" and sent to Paul Jenkins. If you wish to join us, and are not yet signed up, please contact Pat Escott to check if places are still available.

  Saturday 21st January from 10:00 to 16:00 Outreach Day at the Eastgate Centre, Inverness with viewing at the observatory from 20:00 to 23:00. The BBC is hosting another Stargazing Live Day so details may change.

- **Volunteerism.** Help is needed with breakout groups, technology at the meetings, the tea-team, the observatory (training will be given), giving a talk, becoming a committee member or simply giving us your suggestions. All talents can be utilised. Speak to a committee member at the meeting or contact Pat Williams by phone or email.

- **Observing Sessions - JSL Observatory, NTS Visitor Centre Car Park, Culloden Moor.** Please check www.spacegazer.com before setting out. We now have Internet access and can also view the live telescope sightings from the warm room, so if the cold was putting you off, come and try our latest facilities.

Date	For Whom	Time	Supervisor
Fri. 18th Nov.	public and members	20:00 – 23:00	Pat W
Sat. 19th Nov.	members and guests only	20:00 – 23:00	Rhona
Sat. 25th Nov.	public and members	20:00 – 23:00	Pauline
Sat. 26th Nov.	members and guests only	20:00 – 23:00	Paul J

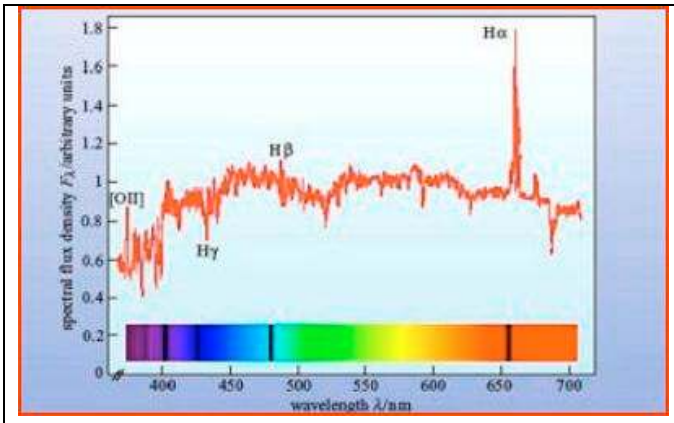
  If a Saturday session is cancelled the supervisor will try to put on an extra session. Please check the website.

- **October Meeting and Stargazey Pie.** 47 people attended the October Meeting. The raffle raised £39.52. The *Pie* was subsequently sent to all members who were unable to attend the meeting.

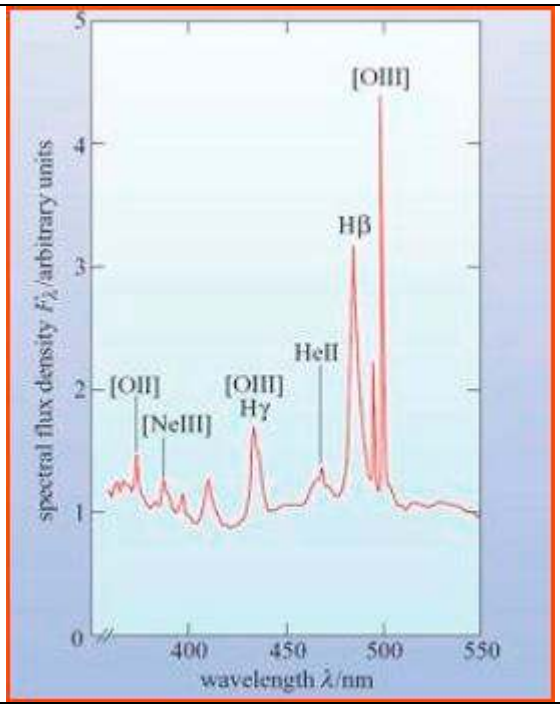
The Main Event
"Active and Starburst Galaxies" by Pauline Macrae

The majority of the talk was on active galaxies. An active galaxy is one that produces an enormous amount of power from a very small area. They look like ordinary galaxies, sometimes even resembling stars, and the main distinguishing factor is the difference in their spectra.

This is the optical spectrum (visible part) of a spiral galaxy. The graph is simply a different way of representing the 'rainbow' that we usually associate with the visible part of the electromagnetic spectrum. The dark lines on the 'rainbow' are absorption lines from stars as are the downward pointing spikes on the graph-like spectrum. Upward pointing lines are emission lines produced by areas of hot gas. You can see absorption and emission lines of hydrogen in the spiral galaxy corresponding to the black lines of the 'rainbow'.



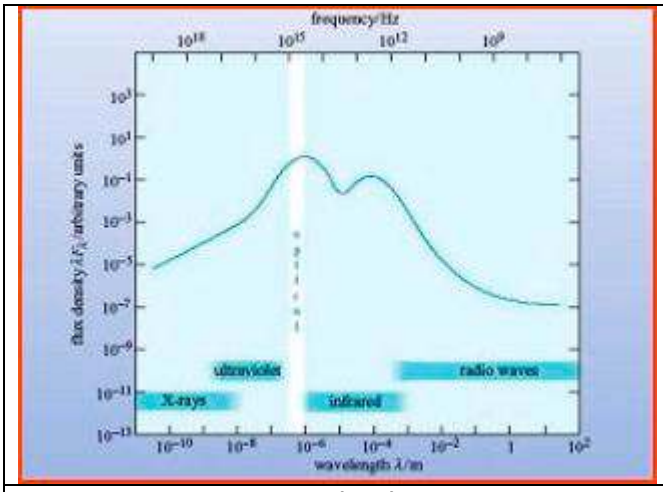
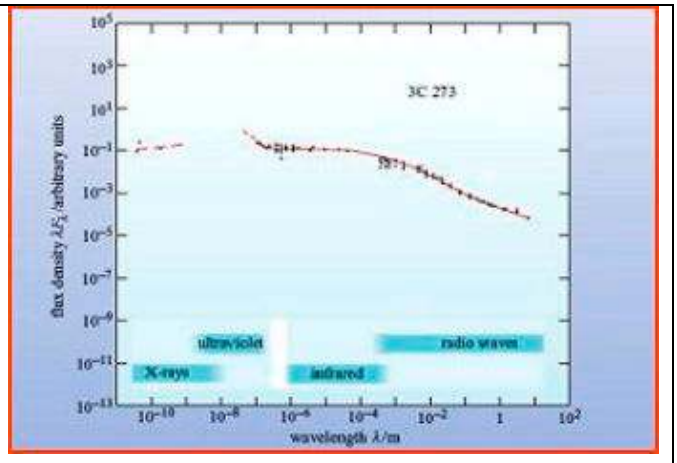
Spectrum of a spiral galaxy



Optical Spectrum of an active galaxy

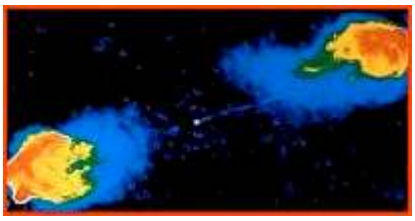
Note the difference between a normal spiral galaxy and an active galaxy. The emission lines for the active galaxy are much stronger and some have wide bases to them. There are no absorption lines.

The second difference is the amount and type of electromagnetic radiation produced. The normal galaxy produces mostly optical radiation (the type we can see) and some infrared, whereas the active galaxy produces radiation across the spectrum.

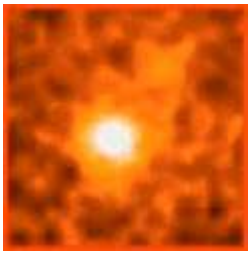
	
Normal galaxy	*Active galaxy*

Seyferts are spiral galaxies with a bright central nucleus.

Quasars are incredibly bright objects that resemble stars that outshine their galaxies.
Their spectra were a great puzzle until it was realised that the emission lines had been
red shifted (moved towards the red end of the spectrum) which tells us quasars are a long way away.



Radio galaxies, found in giant ellipticals, produce huge lobes of radio emission (seen with radio telescopes) far outside the visible extent of the galaxy. The lobes appear to come from jets, which originate from bright points of light.



Blazars also resemble stars. They produce energy from the gamma ray end of the spectrum and are the most powerful objects in the universe.

All active galaxies have compact nuclei that produce enormous amounts of energy (the radiation from across the spectrum) from an area that is only the approximate size of our solar system. The only object able to do that is a **supermassive black hole**.

Around a black hole is an accretion disc (material in orbit around the black hole), which gets so hot that it radiates energy at all wavelengths, e.g. X-rays, ultraviolet radiation, etc. This is surrounded by a giant torus of gas and dust. Clouds of gas lie within the torus, and it is these that produce the strong, wide emission lines (due to the high speeds of the hot gas clouds) seen in some of the spectra of active galaxies. Conversely, clouds of gas from outside the torus, give rise to strong, narrow emission lines. This object is known as an **active galactic nucleus** and the power/energy/radiation from the accretion disc is the source of the active galaxy's power.

There may or may not be a jet. Jets may arise from the dragging of space and time, which winds up the magnetic field lines of a black hole into a coil ejecting charged particles out of the galaxy at speeds close to the speed of light. These produce the lobes, so if there are no jets, as in Seyfert galaxies and 90% of quasars, there will be no lobes. Radio galaxies, 10% of quasars and all blazars have jets.

All active galaxies have an active galactic nucleus at their centre and how these are orientated, and whether or not there is a jet, gives rise to the different kinds of active galaxy we see and is why astronomers often use the term quasar for the active galactic nucleus. They think most galaxies go through a period of quasar activity and if you want to find a dead one, just look in any galaxy with a supermassive black hole – like our own. Could our black hole start feeding again? Yes, if we have a close encounter with another galaxy.

Close galactic encounters give rise to large amounts of star formation and if the rates of star formation are very high these are called **starburst galaxies**. These include many interacting galaxies e.g. M82 and also green pea galaxies which are unusual in that their stars are pure hydrogen and helium indicating they are made from primordial clouds of gas and must be recent – they seem to be only 1.5 billion to 5 billion years old.

There is an old saying in astronomy. "Galaxies are like friends: they are only normal until you get to know them". These are indeed strange galaxies and by studying them it is hoped to shed light on the origin and evolution of all galaxies.

Highland Skies – November 2011

Last month we concentrated on some pretty hard to find supernovae and a rather nice comet. This month, let's turn to Jupiter. I'm writing this at 8.30pm and Jupiter is a good 30 degrees above the horizon. Now that the clocks have gone back we will find ourselves with more practical observing time and the objects we've been longing to see will be higher in the sky at more reasonable hours.

Jupiter is shining at magnitude –2.77 and has a disc that measures nearly 50 arcseconds diameter. That means it has a disc that it is easy to see detail on at reasonable magnification. Mars, for example, is doing very well if it shows us a disc diameter of 25 arcseconds, which is why it can be a bit of a challenge to observe surface features on the red planet with small telescopes.

Jupiter however loves to share its detail with us. And what a lot of detail there is! Before I start going into detail about detail though, perhaps I should first talk about the orientation of the view when observing Jupiter. If you are using a Newtonian telescope, south will be at the top of the

view and north at the bottom. The planet will rotate towards the left edge of the eyepiece field, which is east, and known as the preceding limb.

Using a refractor or a Catadioptric telescope (Schmidt-Cassegrain or Maksutov) with a mirror diagonal will show north at the top and south at the bottom. East (preceding limb) will still be to the left as the mirror diagonal serves to swap left and right about. The disc will still rotate towards the left hand side (celestial east). If you are inclined to use a refractor without a mirror diagonal, ie straight through, then the view and orientation will be the same as if you were using a Newtonian.

The two main dark belts are the Northern Equatorial Belt (NEB) and Southern Equatorial Belt (SEB). The Great Red Spot resides in the SEB, though it is not particularly red at the moment. Between the NEB and the North Polar Region are the North Temperate Belt (NTB) and North north Temperate Belt. These Temperate Belts are narrower than the Equatorial Belts and therefore require more aperture to see clearly. Between the SEB an the Southern Polar Region there are the Southern Temperate Belt and ... you guessed it, the Southern south Temperate Belt.

Jupiter's Galilean moons, Io, Europa, Ganymede and Callisto orbit the gas giant in such a way that they regularly cross the face of the disc. As well as seeing the moons transit the disc, you can also observe the shadows cast by the moons as they cross the disc as well. Sometimes you can also see a moon emerge from behind the planet's disc. All in all, the range of dynamic features that can be seen on or around Jupiter on any one night is huge.

To see good levels of detail on Jupiter you ideally need good quality optics, good seeing, a well cooled telescope and reasonable magnification. Optics-wise, 90mm will show excellent views of the main belts, with some detail (barges, storms) within them and between them (festoons within the "Zones" between the belts), as well the GRS and shadow-transits. Increasing aperture to 120mm, 150mm or 200mm shows increasingly detailed views – as long as the seeing is good enough. Seeing is the greatest equaliser when observing Jupiter. If it's not sufficiently good enough to allow a larger telescope to work at its best then you'll probably see as much as you can see with a smaller aperture. Magnification can be overdone too. Saturn regularly takes powers higher than 200x well, but Jupiter is probably better off somewhere between 160x and 200x most of the time. That's not to say that when the seeing is "perfect" that you can't go higher, of course…

For me, nothing beats a good planetary observing session with a refractor on a driven equatorial mount. I can sit back, let the mount do the tracking and simply make observations and enjoy the view. For details of when transits of the Galilean moons and the GRS are due to take place, have a look in the pages of Astronomy Now magazine or visit the observing section of Sky and Telescope magazine's website. There, you can use are online Java-script utilities that will show you exactly when to look for whatever you want to see.

Antony McEwan

Next Time…

We will have Michael Marett-Crosby giving a talk entitled '*Naming Astronomical Objects'*. James Hitchmough will tell us about his work experience at the Astronomy Department of St. Andrew's University and after the tea-break Arthur will challenge us with his annual Christmas Quiz. (He promises a few easy questions and requests that knowledgeable astronomers team up with less experienced members.) The winning team will be rewarded with the three hats that Rhona brought back from New Zealand.

The meeting will take place on Tues 6th December at 19:30, with the Youngstars junior section (for 8-14 year olds) starting at 19:00.

Clear skies!