



Las Cumbres Observatory Global Telescope

Seeing the Invisible

Targets



FAULKES TELESCOPE

Seeing the Invisible

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Targets

Quasars and Radio Galaxies

Jodrell Bank played a major role in the discovery of quasars, distant galaxies with super-massive black holes at their cores.

In the early 1960's, the Lovell Telescope was linked to a small telescope which was carried to greater and greater distances from Jodrell. This allowed us to zoom in on the quasars showing they were incredibly small and so at very large distances in the universe.

Read more about quasars at:

<http://en.wikipedia.org/wiki/Quasar>

<http://hubblesite.org/newscenter/archive/releases/1996/35/>

<http://www.jb.man.ac.uk/public/story/mk1quasars.html>

Targets

3C 48 (the first quasar to be identified)

Located at RA 01 37 41.3

Dec 33 09 35

3C 84 (also known as NGC 1275, Perseus A)

Search and Browse for NGC1275

Recommended filters and exposure times

RGB, 60 seconds

More Information

Read about 3C 48 at <http://www.jb.man.ac.uk/atlas/object/3C48.html> and at http://en.wikipedia.org/wiki/3C_48

Read about NGC1275 at <http://heritage.stsci.edu/2003/14/supplemental.html>, note link to VLA radio image taken by astronomers at Jodrell Bank, and <http://www.seds.org/~spider/spider/Misc/n1275.html>

Look at the whole Perseus cluster of galaxies in this gorgeous wide-field picture <http://www.rc-astro.com/photo/id1156.html>

Pulsars

Astronomers at Jodrell Bank have observed pulsars (the remnants of exploded stars) since they were first discovered in 1967 by Jocelyn Bell . Most recently they discovered the Double Pulsar, two pulsars orbiting one another – the best test yet of Einstein’s General theory of Relativity.

Read more about pulsars at:

<http://en.wikipedia.org/wiki/Pulsar>

Targets

The Crab Nebula (M1)

Search and Browse for M1

Recommended filters and exposure times

RGB, 60 seconds

More Information

Listen to the sounds of pulsars (including the Crab pulsar) at <http://www.jb.man.ac.uk/~pulsar/Education/Sounds/sounds.html>

Listen to the interview with Jocelyn Bell on the Jodcast at <http://www.jodcast.net/archive/200706/> (link to just this section at <http://www.jodcast.net/archive/200706/20070601-jodcast-interview.mp3>).

Can you identify the Crab Pulsar in your Crab Nebula image?

Star-forming regions

Jodrell Bank studies star formation across the electromagnetic spectrum. Longer wavelengths are particularly useful as they can “see” through the dust clouds that shroud newly forming stars.

Targets

The Orion Nebula (M42)

Search and Browse for M42

Recommended filters and exposure time

RGB, 10 seconds

More Information

Read about star formation and the Orion Nebula at

http://en.wikipedia.org/wiki/Orion_Nebula

Look at the comparison of HST and MERLIN radio imaging of part of the Orion Nebula near the Trapezium stars at <http://www.merlin.ac.uk/biennial/astro.html>

Can you see the Trapezium stars in your Faulkes image?

Gravitational Lens

Following a survey with the Lovell Telescope, the first gravitational lens was discovered in 1979 by a team led by Jodrell astronomer Dennis Walsh. These are classic examples of Einstein's General Theory of relativity in practise – showing how light is bent around massive galaxies creating multiple and distorted images of background objects.

Targets

MG 0414+0534 (A dusty 4-image gravitational lens)

Located at RA 04 14 37.7
Dec 05 34 42.3

Recommended filters and exposure time

Infrared (i'), 120 seconds

The Einstein Cross

Located at RA 22 40 30
Dec 03 21 30

Recommended filters and exposure time

RGB, 90 seconds

More Information

Read about gravitational lensing at http://en.wikipedia.org/wiki/Gravitational_lensing

See images of Double Quasar at <http://www.astr.ua.edu/keel/agn/q0957.html> (optical) and <http://www.jb.man.ac.uk/gallery/> (radio)

Read about the Einstein cross at http://en.wikipedia.org/wiki/Einstein_cross

Read about MG 0414+0534 (including MERLIN radio images) at <http://www.jb.man.ac.uk/research/gravlens/lensarch/MG0414+0534/MG0414+0534.html>

Can you resolve the four images in the Einstein Cross?

Can you confirm that the images in MG 0414+0534 are very red and can you measure their separations and compare to the radio image?

Supernova Remnant

When massive stars explode at the end of their lives they can leave behind a pulsar remnant at the centre but also a cloud of expanding gas which can shine brightly across the electromagnetic spectrum. Cas A is the brightest radio source in the constellation of Cassiopeia, in fact it is one of the brightest radio sources in the whole sky. In visible light it does not stand out so markedly.

Targets

Cassiopeia A

Located at RA 23 23 26.7
Dec 58 48 30

Recommended filters and exposure time

Oxygen-III (OIII) 300 seconds

More Information

Read about supernova remnants at http://imagine.gsfc.nasa.gov/docs/science/know_12/supernova_remnants.html and http://en.wikipedia.org/wiki/Supernova_remnant

Read about Cassiopeia A at http://en.wikipedia.org/wiki/Cassiopeia_A

Compare your optical image to radio and X-ray images available at <http://chandra.harvard.edu/photo/0237/>

Also find Cas A in the all-sky radio map at a frequency of 408 MHz made by Haslam and collaborators using the Lovell Telescope at Jodrell Bank, the Effelsberg Telescope in Germany and the Parkes Telescope in Australia – this can be found at the top of http://antwrp.gsfc.nasa.gov/htmltest/jbonnell/www/multiw_sky.html

and part way down <http://www.cv.nrao.edu/course/ast534/Tour.html> (You may need to use Skyview at <http://skyview.gsfc.nasa.gov/> and enter the name Cas A, select the 0408 MHz radio survey, and gradually increase the field of view labelled as Image size in degrees if you can't spot it immediately).

Estimate the distance to Cas A by measuring its apparent size and looking up the expansion velocity and age.

Galaxy

The radio emission from this galaxy was first discovered by astronomers at Jodrell Bank Observatory using the world's largest telescope (at that time) – the 218-ft Transit Telescope. The first time anyone knowingly detected radio waves from outside our own Milky Way galaxy.

Targets

M31 – the Andromeda Galaxy

Located at RA 00 42 21.5
Dec 41 19 03

Recommended filters and exposure time

RGB, 90 seconds

More Information

Read about the Andromeda Galaxy at http://en.wikipedia.org/wiki/Andromeda_Galaxy

Read about the Jodrell observations including the original scans across the galaxy at <http://cdsads.u-strasbg.fr/abs/1951MNRAS.111..357B>

(click on Full Refereed Journal Article PDF).

Galaxies being monitored for supernovae

Jodrell astronomers are monitoring a number of galaxies for new supernova explosions visible in the radio. NGC 891 is a lovely edge-on galaxy which is on the Jodrell target list. NGC 1058 currently has a supernova SN 2007gr in it which has been detected in the radio by European telescopes including Jodrell Bank.

Targets

NGC 891 – on our radio monitoring list

NGC 1058 – currently has a supernova SN 2007gr in it.

Search and Browse for galaxy NGC numbers.

Recommended filters and exposure time

RGB, 60 seconds

More Information

Read about NGC 891 at <http://seds.lpl.arizona.edu/messier/xtra/ngc/n0891.html>

Identify the dust lane in your image.

Compare your image with previous images (e.g. the one at the above web link) to check for new supernovae – you never know, you could be lucky!

Read about the recent supernova in NGC 1058 at <http://www.rochesterastronomy.org/SNIMAGES/> (look down list for SN 2007gr). Note the link to Astronomers' Telegram 1215 <http://www.astronomerstelegram.org/?read=1215> which describes our recent radio observations.

Can you find the supernova in your image of NGC 1058? Can you measure its brightness.
