ASSA Shallow and Deep Sky Observing Bulletin

Director: Colin Steyn

A Cosmic Wheel of Fire - M83

1. Introduction

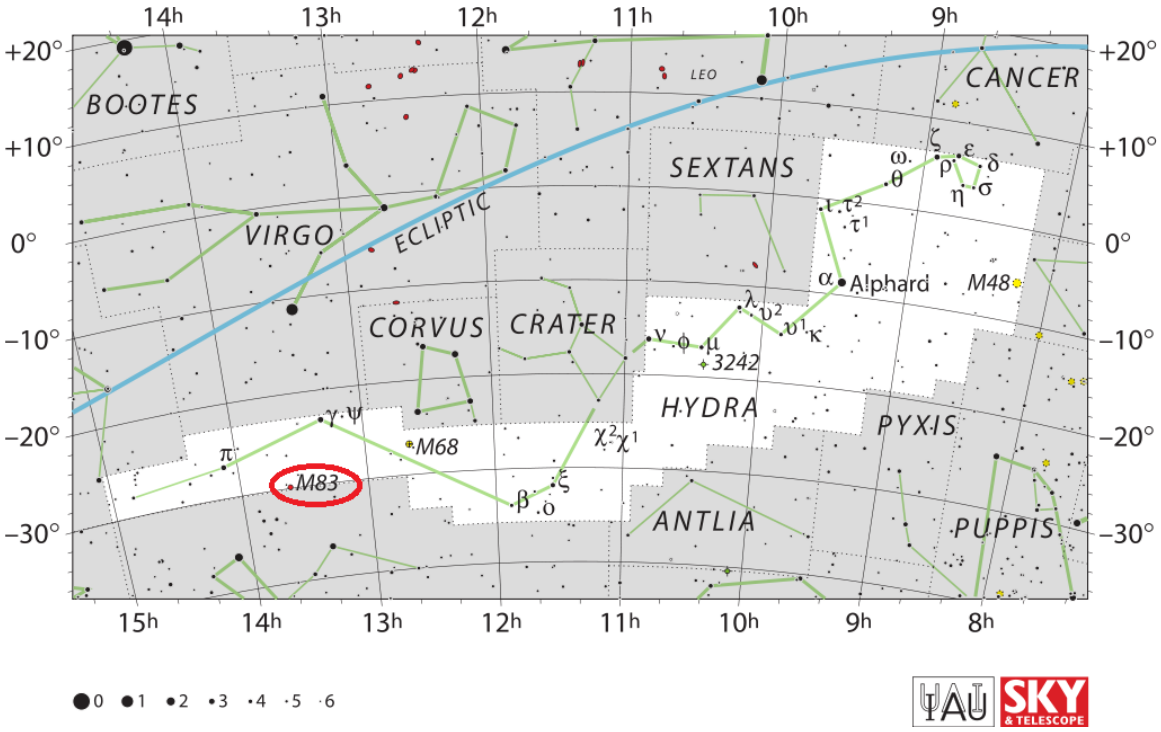
M83, also known as the Southern Pinwheel Galaxy, is a sight to behold from the Southern Hemisphere. Few galaxies in the Southern sky offer as rewarding a combination of accessibility, structure and astrophysical interest as Messier 83 (M83), the Southern Pinwheel Galaxy.

Situated in the constellation Hydra, M83 is a nearly face-on barred spiral galaxy whose sweeping arms make it one of the finest Southern-hemisphere galaxies for amateur observation.

At a distance of approximately 15 million light-years, M83 is one of our relatively close galactic neighbours. It's apparent magnitude of about 7.5 makes it within reach of binoculars under dark skies, while moderate and large telescopes can reveal increasingly subtle details in it's nucleus, spiral arms and dust lanes.

For Southern observers, M83 is particularly significant because it provides an opportunity to study a galaxy whose orientation allows it's overall structure to be appreciated directly. It is an excellent bridge

between shallow-sky observing, where the galaxy appears as a diffuse luminous patch, and deep-sky observing, where its complex spiral structure becomes an observational challenge.


14h
13h
12h
11h
10h
9h
+20°
+10°
0°
−10°
−20°
−30°
BOOTES
LEO
CANCER
SEXTANS
VIRGO
ECLIPTIC
Alphard
M48
CORVUS
CRATER
3242
HYDRA
PYXIS
M68
M83
ANTLIA
PUPPIS
15h
14h
13h
12h
11h
10h
9h
8h
0 1 2 3 4 5 6
IAU
SKY & TELESCOPE

2. Identification and Observational Data

2.1 Designation:	M83 / NGC 5236
2.2 Popular name:	Southern Pinwheel Galaxy
2.3 Messier Designation:	M83
2.4 Constellation:	Hydra
2.5 Object type:	Barred Spiral Galaxy
2.6 Classification:	Grand-design spiral / Starburst Galaxy
2.7 Right Ascension:	13 h 37 m 01 s
2.8 Declination:	-29° 51′ 56″
2.9 Distance:	15 million light-years
2.10 Apparent magnitude:	Approximately 7.5
2.11 Orientation:	Nearly face-on
2.12 Diameter:	40 000 - 55 000 light-years

The published measurements of M83's physical diameter vary because different wavelengths and definitions of the galaxy's outer boundary give different results. ESO describes the main visible galaxy as extending over roughly 40 000 light-years, while infra-red observations trace a larger structure.

3. Historical Background

M83 was discovered in 1752 by the French astronomer Nicolas-Louis de Lacaille during his observations from the Southern Hemisphere in Cape Town.

It's inclusion in the Messier catalogue makes M83 particularly interesting because Charles Messier himself did not discover it. The object was subsequently incorporated into the catalogue, giving modern observers the opportunity to locate this magnificent Southern galaxy using the familiar Messier designation.

The nick-name “Southern Pinwheel” distinguishes M83 from the Northern-sky Pinwheel Galaxy (M101). Although the two galaxies are unrelated, their face-on spiral appearance produces a superficial resemblance.

4. Astrophysical Nature of M83

M83 is a barred spiral galaxy. A prominent bar of stars crosses the central region, with spiral arms extending outward from the galactic nucleus. It's nearly face-on orientation provides an unusually clear view of the galaxy's overall structure.

The galaxy is also undergoing a remarkably active period of star formation. NASA observations show numerous young star clusters associated with the spiral arms, particularly along the boundaries of dark dust lanes. Ultraviolet radiation from these young stars illuminates surrounding hydrogen gas, producing the spectacular emission regions revealed in detailed images.

M83 is therefore not merely a beautiful spiral galaxy - it is an active laboratory for studying the birth, evolution and death of stars.

5. The Galactic Nucleus

The nucleus of M83 is considerably more complex than it's symmetrical appearance might suggest.

ESO observations describe unusual structure within the central region approximately 1000 light-years across, including evidence for a double nucleus and a double circumnuclear starburst ring. The central region also contains the bar that helps channel material towards the galactic centre.

For the visual observer, however, the nucleus will normally appear as a relatively bright concentrated central condensation. The finer structure seen in professional observations is well beyond the reach of most amateur telescopes. Nevertheless, the apparent central concentration provides an excellent reference point when attempting to trace the faint spiral arms outward.

6. Star Formation and Spiral Arms

One of M83's most important scientific characteristics is it's exceptionally active star formation.

The spiral arms contain extensive clouds of gas and dust. Within these regions gravity causes dense pockets of the interstellar medium to collapse, forming new stars. The youngest massive stars emit intense ultraviolet radiation, which illuminates the surrounding hydrogen gas.

Hubble Space Telescope observations have revealed hundreds of young star clusters and hundreds of thousands of individual stars in the Galaxy. Many of the youngest clusters occur along the edges of the dark dust lanes that define the spiral arms. This produces a fascinating cycle:

Gas and dust → gravitational collapse → new stars form → stellar winds and supernovae → enriched inter-stellar medium → further star formation.

M83 therefore provides an excellent example of the continuing stellar life cycle operating on a galactic scale.

7. Supernovae in M83

M83 has been an exceptionally productive galaxy for Supernova observations. ESO notes that six Supernovae have been observed in M83 during the past century, consistent with it's high rate of star formation.

Hubble observations have also identified numerous supernova remnants. These remnants are important because massive stars manufacture many of the heavier chemical elements in their interiors and distribute them into interstellar space when they die.

Consequently, observations of M83 provide astronomers with information about stellar birth and stellar death.

8. Observing M83

M83 is an excellent object for optical observers as it can be detected with relatively modest equipment.

8.1 Binoculars

Under dark sky M83 can be detected with binoculars. Expect to see:

- A small, diffuse glow
- A brighter central condensation
- Little or no structure
- A noticeably different appearance from a star because the object remains diffuse when the binoculars are focused.

The challenge is not necessarily finding M83, but recognising it as a galaxy against the background sky.

8.2 Small Telescopes (70 - 130 mm)

The central region becomes more obvious. Under good conditions the galaxy may appear as a softly elongated nebulous patch. Averted vision is extremely useful.

8.3 Intermediate Telescopes (130 - 250 mm)

Under dark skies observers may notice:

- A bright central nucleus
- An extended oval halo
- Uneven brightness across the disk
- Hints of a spiral structure
- Darker regions interrupting portions of the Galaxy
- Possible indications of the major spiral arms

The appearance will depend strongly on sky transparency. M83 is sufficiently large and diffuse that dark skies are often more important than extreme magnification.

8.4. Large Telescopes (250 mm-)

Substantially more structure are revealed. With apertures above 300 mm spiral arms become visible. Variations in surface brightness can also be detected. The arms of M83 are not uniformly bright; they contain concentrations of stars, gas and dust, producing alternating bright and dark regions. Allow your eyes to become fully dark adapted and use averted vision.

Once the general shape has been established, gently move the telescope around the field. Small changes in the angle of observation can make extremely faint features more apparent.

9. Filters

Unlike emission nebulae, M83 is primarily a continuum source, so conventional nebular filters such as O III and UHC filters do not provide the dramatic improvement they can produce on objects such as the Eta Carina and Rosette Nebulae.

For general Galaxy observation, an unfiltered view is usually preferable.

10. Scientific Significance

10.1 Nearby laboratory for star formation

10.2 Studying how a galactic bar influences the movement of gas.

10.3 Starburst activity

10.4 Stellar evolution

10.5 Galactic chemical enrichment

11. Astrophotography

M83 is an outstanding Astro photographic target.

It's nearly face-on orientation allows long exposures to reveal the spiral arms, dust lanes, star forming regions and central bar.

Modern DSLR cameras and electronically assisted astronomy systems can reveal considerably more detail than the human eye can perceive through an eye piece.

For imaging, a useful strategy is to obtain:

- A series of short exposures to preserve the bright nucleus.
- Longer exposures to capture the faint outer arms
- A large number of sub-exposures for improved signal-to-noise ratio
- Accurate guiding
- Dark transparent skies whenever possible.

12. Conclusion

M83 is one of the outstanding galactic targets of the Southern sky. At first glance it may appear a little more than a diffuse patch of light. With patience, dark skies and increasing aperture however, the observer can begin to appreciate the enormous structure contained within that small patch of light.

The photons reaching the observer have travelled for approximately 15 million years before entering the telescope. They carry information about billions of stars, immense clouds of gas and dust, active regions of stellar birth and the remnants of stars that have already ended their lives.

For the ASSA observer, M83 therefore represents much more than another Messier object, it is a superb Southern-Sky laboratory for learning how to observe galaxies, understand their structures and appreciate the enormous scale of the Universe.

M83 - The Southern Pinwheel - should be considered a priority Deep-Sky target for every Southern-Hemisphere observer.

May you have clear skies and happy observing!

Colin Steyn

ACKNOWLEDGEMENTS

1. Collins Stars & Planets. Ian Ridpath & Wil Tirion. Harper Collins Publishers. London. 2007.
2. The Mitchell Beazley Guide to the Stars. John Sanford. Mitchell Beazley Publishers. 1989.
3. Phillips Atlas of the Universe. Patrick Moore. George Philip Limited. 2005.
4. The Practical Skywatcher's Handbook. Consulting Editors David H. Levy and Dr John O'Byrne. Weldon Owen Pty Ltd. 2002.
5. Astronomy. L.A. Rousse. New Revised Edition. Published by Hamlyn Publishing Group Limited. 1981.
6. Space.com

7. GoAstronomy.com
8. NASA / JPL - Southern Pinwheel
9. ESO - The Southern Pinwheel
10. NASA Science - Messier 83 / The Southern Pinwheel
11. Commons.wikimedia.org
12. Sky & Telescope
13. www.deepskycorner.ch