CCD Photometry of the Weakly Barred Triple-Ringed Galaxy IC 4214

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Abstract.   We present a brief report on the B, V, R, I, and Hα CCD
surface photometry of the southern SABab galaxy IC 4214. We obtained
isophote maps, luminosity profiles, and basic geometric and photometric
parameters in $BVRI$, and mapped the distribution of the gas through
continuum subtracted Hα emission line images.

1.   Introduction

The southern galaxy IC 4214, classified as $(R')SB(r)ab$ in the RC3 (de Vau-
couleurs et al. 1991), is an example of a weakly barred galaxy with the three
main ring types possible in a galaxy: a nuclear ring (9.5 x 8.5 arcsec), an inner
ring (52 x 27 arcsec), and an outer ring (118 x 73 arcsec). The three rings were
previously shown in the $B - I$ map by Buta & Crocker (1991).

  The inner and outer ring are connected by two enhanced regions located
in both extremities of the inner ring. The weak bar is not clearly distinct from
the inner ring, appearing as a mixture of the types "ring/lens" barlike distortion
and "spiral" distortion (Buta 1986). The morphology of the galaxy is illustrated
in Figure 1.

2.   Observations

  The observations were made in June 1992 using the TEK 1024 CCD at the
91 cm telescope of the Cerro Tololo Inter-American Observatory (CTIO). The
filters used were B, V, R, I, and two narrow filters of 75 Å wide centered at
6649 Å (to isolate the Hα emission line at the redshift of the galaxy) and at
6477 Å (to isolate a nearby region of stellar continuum).

3.   Results

The total apparent magnitude and color of IC 4214, obtained from photoelec-
trically calibrated synthesized elliptical apertures, are m(B) = 12.25 and $B - V$
= 0.88. After correcting by Galactic and internal absorption the corresponding
absolute magnitude is $M_T^o(B) = -20.44$ (based on the radial velocity corrected
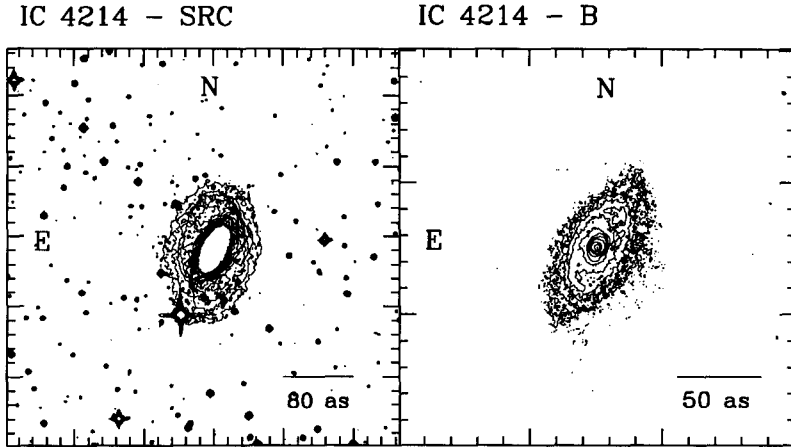
IC 4214 – SRC   IC 4214 – B

Figure 1.   Isophote maps of IC 4214. Left: based on the digitized
SRC plate; shows the isophotes external to the inner ring. Right: based
on our CCD *B* image; shows the isophotes internal to the outer ring.

to the Galactic Standard of Rest in RC3, V = 2135 km s^{-1}, and assuming H =
85 km s^{-1} Mpc^{-1}). The effective equivalent radius is $r_e^* = 21$ arcsec = 2.6 kpc.

Ellipse fits to the isophotes show that the inner ring is the most elongated
feature in the galaxy; the nuclear ring is almost round, and nearly parallel to
the inner ring; the outer ring has the same orientation and ellipticity of the
bulge. The bulge is not spherical, showing distorted oval-rectangular isophotes
and asymmetric luminosity profiles in the direction of the major axis of the
inner ring. The color profiles are very noisy, indicating the presence of dust in
the bulge region. The existence of the dust appears more clearly in the mean
$B - I$ profile, where it makes a strong bump centered at $r = 12''$. In spite of
the dust, the mean profile obtained from the ellipse fits follows an $r^{1/4}$ law (de
Vaucouleurs 1948) in the bulge region (r < 16 arcsec).

A Fourier analysis with a sinusoidal basis shows that the m=2 and m=4
components have maxima in the surroundings of the inner ring, reinforcing the
existence of a bar or oval in this region. These two components contribute 21%
of the *B* and *I* luminosity within $r = 80''$.

Continuum-subtracted Hα emission line images (Figure 2) show that the
emission is concentrated at the nucleus, the nuclear ring and the two spiral arms
that form the inner ring. The nuclear ring is complete in Hα, but in the $B - I$
map it appears as an arc-shaped feature located in the Northeast side of the
galaxy center. The colors of the nuclear ring [$(B - V)^o = 0.72$, $(V - R)^o = 0.53$, $(V - I)^o = 1.1$] indicate it contains star formation regions. The connection
between nuclear rings of star formation and bars (Arsenault 1989; Pogge 1989)
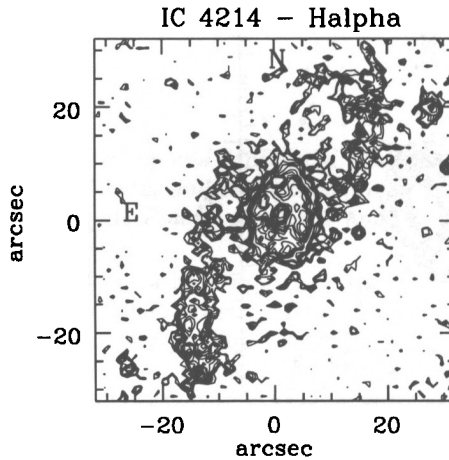is another indication of the existence of a barred structure in IC 4214.

Figure 2.   Hα map of the inner region of IC 4214, based on the continuum-subtracted Hα emission line images.

References

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