

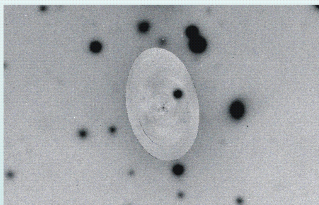


THE COLLISIONAL GALAXY PAIR FM 047-02 (*)

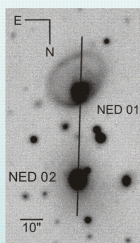
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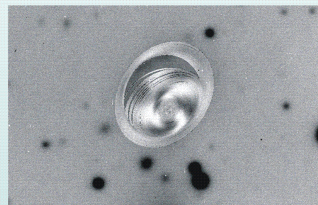
(*) Based on observations made at the Gemini Observatory, under the identification number GS-2007A-DD-06



The NED02 model after the original image subtraction. Based on these results, an E4-type may be assigned to this galaxy.



The Solitaire-like galaxy NED01 and its companion NED02. Optical 5 minutes GMOS image in the r-G0303 filter with effective wavelength 630 nm, enhanced by a kernel of 300 pixels (Faúndez-Abans & de Oliveira-Abans 1998b). The slit position PA = 28° is also displayed.



The NED01 model after the original image subtraction. The bright and dark patterns indicate the presence of probable non-elliptical tidal substructures.

INTRODUCTION

In their work on the morphology of peculiar Ring Galaxies (pRGs), Faúndez-Abans & de Oliveira-Abans (1998a - FAOA), compressed the existing morphological categories of pRGs into five families, following the general morphology of the galaxy-ring structures. In Table 1 of FAOA, eight morphological subdivisions are highlighted. One of them is a basic structure called "Solitaire". It is described as an object of which bulge is located on the ring, or very close to it, resembling the one-diamond finger ring (a one-knot ring). In these objects, the region of the ring on the opposite side of the bulge generally looks smooth and thin (for archetypes, see FM 188-15/NED02 and AM 0436-472/NED01). Despite the poor statistics on this class of objects, the companion galaxy may be almost elliptical-like.

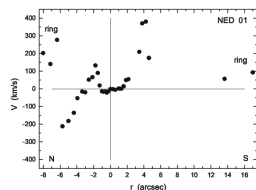
FM 47-02 REVIEW

There are only few references quoted in the literature for this object, started early with Theys & Spiegel (1976) in which collisional rings can be subdivided by morphological classes RE (empty rings), RN or RK (rings with nuclei, or with dominant knots), Few & Madore (1986) divided this ring galaxies into two broad sub-types: P-type rings, which have a crispy knotty structure and often an off-center nucleus, and that are probably collisional (they happen to have a significant number of companions lying within a distance of about two ring diameters); and O-type rings, which have a smooth structure and a centrally located nucleus, no obvious companions and that are likely to be resonant (R)S galaxies, Arp & Madore (1986) at the Catalogue of Southern Peculiar Galaxies and Associations (see also Madore et al. 2009), and in the FAOA classification. There are redshift measurements for NED02 by Jones et al. 2009 (and references quoted), of which values changed after two released data in NED. The FM 47-02 galaxy pair is divided in NED as: NED01 the ringed galaxy (2MASX J20262950-7236443) and NED02 an elliptical-like object (2MASX J20263396-7236083).

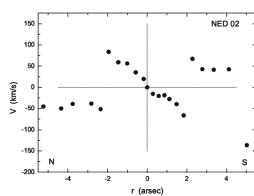
OBSERVATIONS AND DATA REDUCTION

The spectroscopic observations of FM 047-02 were performed with the 8.1-m Gemini South telescope in Chile -- ID program GS-2007A-DD-06. We used the GMOS spectrograph in long-slit mode (Hook et al. 2004). A description of the instrument can be found at <http://www.gemini.edu/sciops/instruments/gmos>. The grating R400+G5325 (400 lines/mm), centered 676.5 nm, was used with an 1.5-arcsec wide by 375 arcsec long slit. The data were binned by 4 in the spatial dimension and by 2 in the spectral dimension producing a spectral resolution of ~5.1 FWHM sampled at 0.68 Å/pix. The seeing throughout the observations was 1.5 arcsec and the binned pixel scale was 0.145 arcsec/pix. The wavelength range was ~3500-7000 Å. The photometric standard star LTT 7379 was also observed using the same experimental setup. The longslit spectra were taken at the same position angle on the sky: PA = 28°, to comprise both objects in one shot and almost crossing both centers of the objects.

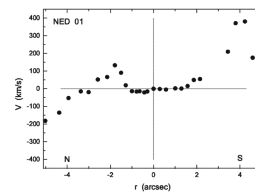
The standard Gemini-IRAF routines were used to carry out bias subtraction, flat-fielding, and cosmic ray subtraction. The data was then wavelength calibrated with the wavelength calibration being accurate to ≤ 0.3 Å. The 2-D spectrum was then extracted into a series of 1-D spectra which were then sky-subtracted and binned in the spatial dimension. The binned 1-D spectra were then flux-calibrated using the photometric standard star LTT 7379.



The NED01 observed radial-velocity distribution of the nucleus bulge and ring sections, along the total longslit: from -8 to 16 arcsecs.



The NED02 observed radial-velocity distribution of the nucleus, bulge, and external features, respectively. The nucleus and bulge regions are typical of ellipticals.



The central NED01 -5 to 5 arcsecs nuclear and bulge features. The center of the object is not as tidally perturbed as the external regions, where they meet the ring.

PRELIMINARY RESULTS

NED01 shows clear signatures of tidal perturbations. The systemic velocity is 22,919 km/s ($z = 0.0764$), and the spectra show early-type features. No evidences of emission lines were detected in the observed sections of the ring. NED02 is an elliptical galaxy (possibly an E4), with systemic velocity of 22,773 km/s ($z = 0.0760$). The velocity difference of 146 km/s confirms the close companionship of both objects. Based on the velocity curves, especially that of NED02, which clearly displays decoupling of the central and external regions, the Solitaire system seems to be the result of a close encounter between an elliptical galaxy and an S0 (poor in gas and dust), or an E7.

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REFERENCES

- Arp, H.C., Madore, B.F. 1986, Catalogue of Southern Peculiar Galaxies and Associations, Vol. I, Positions and Descriptions, Clarke-Irwin, Toronto
Faúndez-Abans M., & de Oliveira-Abans M. 1998a, A&AS, 129, 357 (FAOA)
Faúndez-Abans M., & de Oliveira-Abans M. 1998b, A&AS, 128, 289
Few, J. & Madore, B.F. 1986, MNRAS, 222, 673
Hook, I.M. et al. 2004, PASP, 166, 425
Jones, D.H., Read, M.A., Saunders, W. et al. 2009, MNRAS, 399, 683
Madore, B.F., Nelson, E. & Pettilio, K. 2009, ApJs, 181, 572
Schlegel, D.J., Finkbeiner, D.P., Davis, M., 1998, ApJ, 500, 525
Theys, J.C. & Spiegel, E.A. 1976, ApJ, 208, 650
Van Zee, L., Skillman, E.D. & Haynes, M.P. 2004, AJ, 128, 121

