ΣΥΝΕΔΡΙΑ ΤΗΣ 1ΗΣ ΔΕΚΕΜΒΡΙΟΥ 1977

ΠΡΟΕΔΡΙΑ ΠΕΤΡΟΥ ΧΑΡΗ

ΑΣΤΡΟΝΟΜΙΑ.— **A Microdensitometer Tracing of a New Elliptical Galaxy in Cepheus,** *by J. Xanthakis and C. Poulakos* *.

SUMMARY

Apparent red magnitude, Isophotal maps, luminosity profiles along the major and the minor axes are presented for the Xanthakis and Poulakos object 1.

INTRODUCTION

In a previous paper (Xanthakis and Poulakos 1977) it has been reported the discovery of two very red objects on the Palomar Observatory Sky Survey prints. Both objects 1 and 2 (hereafter referred to as XP1 and XP2) were visible on the red and blue POSS prints. Due to their general morphological characteristics, we presumed that both XP1 and 2 are galaxies of elliptical type. XP1 is the brightest member of the two objects. The position is $\alpha_{1950} = 21^h 52^m 34^s$, $\delta_{1950} = +\ 75^\circ 14' 26''$. XP2 lies 4.89 arc min SW of XP1 and is strong on the red but just visible on the blue POSS chart. The position of XP2 is $\alpha_{1950} = 21^h 51^m 46^s$, $\delta_{1950} = +\ 75^\circ 09' 48''$.

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The present paper deals with XP1 which has been studied photometrically. Our purpose is to investigate the nature, the structure and the linear dimensions of the object by means of photographic material taken during July 1977 at the Observatory of Haute - Provence.

OBSERVATIONS

Direct plates were taken with the 60/90/208 cm Schmidt telescope of the Haute - Provence Observatory. Spectral plates were taken with the 12° 15′ objective prism attached to the telescope. Kodak IIa - O plates were exposed through a Schott GG 385 filter and 103a - D plates through a Schott GG 495 filter for the B and V spectral region respectively. Long exposure Kodak 103a - F + RG 610 plates were used for the R spectral region reaching a limiting magnitude of $m_R = 15.8$.

PHOTOGRAPHIC OBSERVATIONS AND ISOPHOTES

Object XP2 is not visible on the coloured and the spectral plates. However, this result was expected because of the faintness of XP2. Object XP1 is clearly visible on the long-exposure red plates but hardly visible on the yellow ones. No traces of XP1 are seen on the blue plates. The more or less fuzzy spectrum of XP1 on the objective prism plates on one hand and the low dispersion spectrum (1760 A/mm) on the other hand did not permit any final classification of XP1.

The red photographic plates were used in two ways: to estimate the total apparent magnitude of XP1, and to obtain isophotal maps and luminosity profiles along the two axes of the object.

The iris photometer of the Research Center for Astronomy and Applied Mathematics of the Academy of Athens was used to estimate the red magnitude of XP1 which was found equal to $R = 14.^m2 \pm 0.^m10$. The catalogues of Blanco (1968) and Nilson (1973) provided the calibration data for the photometry.

All plates were scanned on a Joyce - Loeble (JL) isodensitometer at the cited institute. Figure 1 represents one isophotal map of XP1 with density interval 0.10. The very steep intensity gradient near the nucleus of XP1 is clearly evident in the isophote.

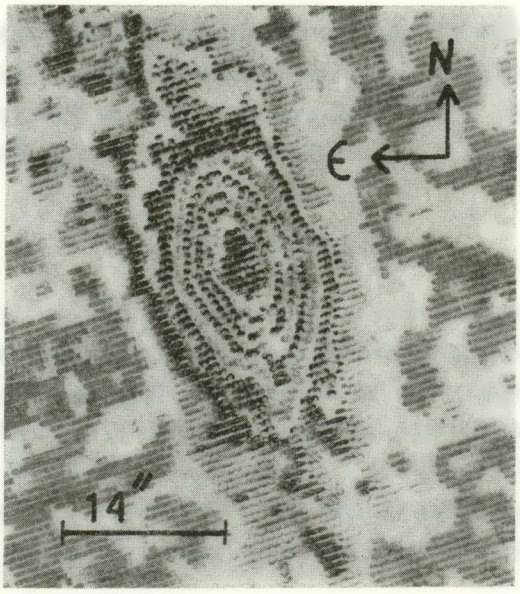

Fig. 1. Isophotal map of XP1 derived from a IIIa-F + RG 610 red plate. Density interval 0.10.

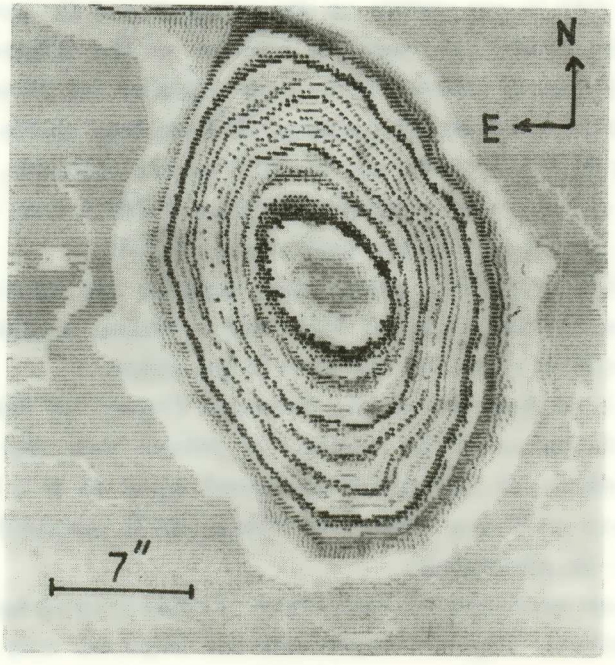

Fig. 2. Isophotal map of XP1 derived from a reproduction on a transparency from the red POSS print.

The elliptical shape and an elongated halo are also evident in Figure 1. The major axis of the galaxy is oriented along north-east to south-west.

A reproduction on a transparency of XP1 from the red POSS print was also scanned with the JL isodensitometer. The density interval was 0.50. The POSS isophotal map is shown in Figure 2.

The fine structure and the changes of the intensities shown in Figure 1 were lost in Figure 2 due to the various reproductions and magnifications made on XP1.

However the elliptical shape and the nucleus, lightly distorted, are evident in this Figure.

LUMINOSITY PROFILES

The Haute - Provence 103a - F + RG 610 red plates were analyzed by means of several tracings along the major and the minor axes of XP1,

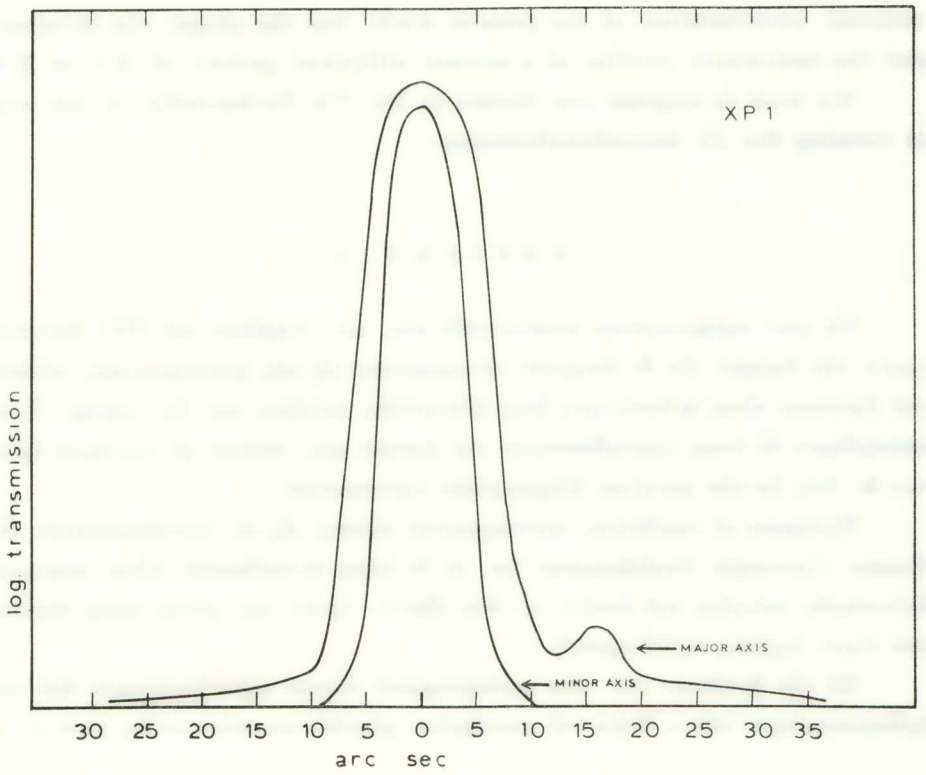

Fig. 3. Luminosity profiles of the major and the minor axes of XP1.

obtained with the help of a microphotometer. No detailed attempt was made to correct the microphotometer tracings for the resolving powers of the instrument.

Figure 3 presents a sample of the luminosity profiles along the major and the minor axes of XP1.

Appart the small peculiarities there is a symmetry between the two sides of the luminosity profiles of both axes, a quite typical phenomenon for elliptical galaxies.

The nebula can be traced to a total diameter of about 30 arc sec. It should be noted that the major axis plotted in Figure 3 was measured along a north-east to south-west straight line. The mean axial ratio was found equal to $b/a = 0.5$.

CONCLUSIONS

From the above results it is concluded that XP1, within the observational uncertainties of the present study, has the shape, the structure and the luminosity profile of a normal elliptical galaxy of E5 to E6.

We wish to express our thanks to Mr. Th. Zachariadis for his help in running the JL microdensitometer.

ΠΕΡΙΛΗΨΙΣ

Εἰς μίαν προηγουμένην ἀνακοίνωσίν μας τὸν Ἀπρίλιον τοῦ 1977 διετυπώσαμεν τὴν ἄποψιν ὅτι ἓν ἀστρικὸν ἀντικείμενον εἰς τὰς φωτογραφικὰς πλάκας τοῦ Palomar εἶναι πιθανώτατα ἕνας ἐλλειπτικὸς γαλαξίας καὶ ὄχι ἀστήρ. Ἐπεφυλάχθημεν δὲ ὅπως ἐπαληθεύσωμεν τὴν ἄποψίν μας ταύτην μὲ νεωτέραν ἔρευναν δι' ἑνὸς ἐκ τῶν μεγάλων Εὐρωπαϊκῶν τηλεσκοπίων.

Πράγματι αἱ ληφθεῖσαι φωτογραφικαὶ πλάκες εἰς τὸ Ἀστεροσκοπεῖον τῆς Haute - Provence ἐπεβεβαίωσαν ὅτι τὸ ἐν λόγῳ ἀντικείμενον εἶναι πράγματι ἐλλειπτικὸς γαλαξίας τοῦ ὁποίου οἱ δύο ἄξονες ἔχουν τὰς αὐτὰς τιμὰς περίπου ποὺ εἶχαν ἀρχικῶς προσδιορισθῆ.

Μὲ τὴν βοήθειαν τοῦ νέου φωτομετρικοῦ ὑλικοῦ προσεδιορίσαμεν διὰ τοῦ ἰριδοφωτομέτρου τύπου Baker τὸ φαινόμενον μέγεθός του ποὺ εὑρέθη 14.5 εἰς τὸ

ἐρυθρόν, διὰ δὲ τοῦ μικροφωτομέτρου τύπου Joyce - Loeble τοῦ Κέντρου Ἐρεύνης Ἀστρονομίας καὶ Μαθηματικῶν ἐμελετήσαμεν καὶ τὴν λεπτὴν ὑφὴν τῆς δομῆς τοῦ νέου γαλαξίου.

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Ὁ Ἀκαδημαϊκὸς κ. **Ἰωάννης Ξανθάκης**, παρουσιάζων τὴν ἀνωτέρω ἀνακοίνωσιν, εἶπε τὰ ἑξῆς :

Γαλαξίαι ἢ ἐξωγαλαξιακὰ νεφελώματα εἶναι ἀστρικὰ συστήματα ποὺ εὑρίσκονται εἰς τεραστίας ἀποστάσεις ἀπὸ τὴν Γῆν, ἀποτελοῦνται δὲ ἀπὸ διεσεκατομμύρια ἡλίων διαφόρων φασματικῶν τάξεων. Ἐκτὸς τῶν ἀστέρων ὅμως περιέχουν εἰς τὸ μεσοαστρικὸν διάστημα καὶ διάσπαρτον κοσμικὴν ὕλην δηλ. ποσότητας ἀερίων ἢ κονιορτοῦ. Ἐκ τῶν ὁποίων δημιουργοῦνται οἱ ἀστέρες ὅπως πιστεύομεν σήμερον. Οἱ γαλαξίαι παρουσιάζουν διαφόρους μορφὰς καὶ δύνανται νὰ ταξινομηθῶσιν κατὰ τὸν Humble εἰς 3 μεγάλας κατηγορίας :

1) Εἰς τοὺς ἐλλειπτικοὺς γαλαξίας ποὺ ἐμφανίζονται εἰς τὰς φωτογραφικὰς πλάκας ὑπὸ ἐλλειπτικὴν μορφὴν μὲ διάφορον ἐκκεντρότητα.

2) Εἰς τοὺς σπειροειδεῖς γαλαξίας ποὺ ἐμφανίζουν ἕναν κεντρικὸν πυρῆνα ἀπὸ τὸν ὁποῖον ἐκτοξεύονται σπειροειδεῖς βραχίονες καὶ 3) εἰς τοὺς ἀνωμάλους γαλαξίας τῶν ὁποίων ἡ μορφὴ εἶναι ἐντελῶς ἀνώμαλος. Ἡ ἀνωτέρω ταξινόμησις στηρίζεται εἰς τὴν μορφὴν τὴν ὁποίαν ἐμφανίζουν οἱ γαλαξίαι εἰς τὰς φωτογραφικὰς πλάκας ἀπὸ τὴν μορφὴν μᾶλλον τοῦ Hubble διάγραμμα καὶ τὴν πιθανὴν ἐξέλιξιν τῶν Γαλαξιῶν. Κατὰ τὰς 2 ὅμως τελευταίας δεκαετηρίδας ἤρχισεν ἡ συστηματικὴ μελέτη τῶν γαλαξιῶν ἐπὶ τῇ βάσει ὄχι μόνον τῆς μορφῆς των ἀλλὰ καὶ τῶν φυσικῶν χαρακτηριστικῶν των. Πράγματι ὁ Morgan καὶ οἱ συνεργάται του διὰ τὴν ταξινόμησιν τῶν γαλαξιῶν ἔλαβεν ὑπ' ὄψιν του 3 βασικὰς παραμέτρους 1) τὸν βαθμὸν συγκεντρώσεως τῆς λαμπρότητος περὶ τὸ κέντρον τοῦ γαλαξίου. Ἡ λαμπρότης αὕτη παριστᾶ χονδροειδῶς τὸ ἀστρικὸν περιεχόμενον τοῦ κέντρου τοῦ γαλαξίου, 2) τὸ σχῆμα αὐτοῦ καὶ 3) τὸν προσανατολισμὸν τοῦ πρω-

τεύοντος ἐπιπέδου τοῦ γαλαξίου ὡς πρὸς τὸν παρατηρητὴν καὶ προκειμένου περὶ τῶν ἐλλειπτικῶν γαλαξιῶν τὴν πλάτυνσίν των ποὺ ἐκφράζεται διὰ τῶν ἀριθμῶν 0 ἕως 7· δηλαδὴ ὁ ἀριθμὸς 1 ἀντιστοιχεῖ εἰς γαλαξίαν μὲ κυκλικὸν σχῆμα ἐνῷ ὁ ἀριθμὸς 7 εἰς γαλαξίαν ποὺ ἐμφανίζεται λίαν ἐπιμήκης.

Οἱ ἐλλειπτικοὶ γαλαξίαι ποὺ ἰδιαιτέρως μᾶς ἐνδιαφέρουν εἰς τὴν παροῦσαν ἀνακοίνωσιν ἀποτελοῦν τὰ 18% περίπου τοῦ συνόλου τῶν γαλαξιῶν καὶ εἶναι διαφόρου μεγέθους. Οἱ γίγαντες ἐλλειπτικοὶ γαλαξίαι ἔχουν τεραστίαν ἔκτασιν καὶ ἐμφανίζονται κατὰ τὸ μᾶλλον ἢ ἧττον ἀπομεμονωμένοι, ἐνῷ οἱ μικροῦ μεγέθους δηλ. οἱ νάνοι ἐλλειπτικοὶ ἐμφανίζονται κυρίως ὡς συνοδοὶ τῶν γιγάντων γαλαξιῶν παντὸς τύπου. Τυπικὸν παράδειγμα ἀποτελεῖ ἡ ὁμὰς τῶν γαλαξιῶν τοῦ ἀστερισμοῦ τῆς παρθένου ποὺ περιβάλλονται ἀπὸ 6 τουλάχιστον ὁρατοὺς νάνους ἐλλειπτικοὺς γαλαξίες. Μὲ τὰ μεγάλα τηλεσκόπια τοῦ ὄρους Wilson καὶ Palomar κατέστη δυνατὸν οἱ ἐγγύτεροι ἐκ τῶν ἐλλειπτικῶν γαλαξιῶν νὰ ἀναλυθοῦν εἰς ἀστέρες καὶ νὰ μελετηθῇ ἡ φύσις τῶν ἀστέρων τούτων. Ἐκ τῆς ἐρεύνης ταύτης διεπιστώθη ὅτι τὸ μέγιστον τῆς λαμπρότητος τῶν ἐλλειπτικῶν γαλαξιῶν ὀφείλεται εἰς τὴν παρουσίαν ἐντὸς αὐτῶν κιτρίνων καὶ ἐρυθρῶν γιγάντων ἀστέρων ποὺ ἀντιπροσωπεύουν καὶ τὸ μεγαλύτερον ποσοστὸν τῆς ὁλικῆς μάζης τῶν ἐλλειπτικῶν γαλαξιῶν ποὺ εἶναι τῆς τάξεως τῶν 100 δισεκατομμυρίων ἡλιακῶν μαζῶν.

Εἰς μίαν πρόδρομον ἀνακοίνωσίν μας κατὰ τὸν παρελθόντα Ἀπρίλιον διετυπώσαμεν τὴν ἄποψιν ὅτι ἕνα ἀστρικὸν ἀντικείμενον εἰς τὰς φωτογραφικὰς πλάκας τοῦ Ἀστεροσκοπείου Palomar εἶναι πιθανώτατα ἕνας ἐλλειπτικὸς γαλαξίας καὶ ὄχι ἀστὴρ τοῦ ὁποίου προσδιορίσαμεν τὴν θέσιν καὶ τὰ μεγέθη τοῦ μεγάλου καὶ τοῦ μικροῦ ἄξονος. Ἐπιφυλάχθημεν δὲ ὅπως ἐπαληθεύσωμεν τὴν ἄποψίν μας ταύτην μὲ νεωτέραν ἔρευναν δι' ἑνὸς ἐκ τῶν μεγάλων Εὐρωπαϊκῶν τηλεσκοπίων. Πράγματι κατόπιν συνεννοήσεως μὲ τὸν Γάλλον ἀκαδημαϊκὸν κ. Fehrenbach ἐτέθη εἰς τὴν διάθεσίν μας κατὰ τὸ παρελθὸν θέρος τὸ τηλεσκόπιον Schmidt τοῦ Ἀστεροσκοπείου τῆς Heute Provence. Αἱ ληφθεῖσαι φωτογραφίαι ὑπὸ τοῦ κ. Πουλάκου τὸν παρελθόντα Ἰούλιον ἐπιβεβαίωσαν ὅτι τὸ ἐν λόγῳ ἀντικείμενον εἶναι πράγματι ἐλλειπτικὸς γαλαξίας τοῦ ὁποίου οἱ δύο ἄξονες ἔχουν τὰς αὐτὰς τιμὰς περίπου ποὺ εἶχαν ἀρχικῶς προσδιορισθεῖ. Ἐπὶ πλέον μὲ τὴν βοήθειαν τῶν νέων φωτογραφικῶν πλακῶν προσδιορίσαμεν διὰ τοῦ ἰριδοφωτομέτρου τύπου Baker τὸ μέγεθός του ποὺ εὑρέθη 14.5 εἰς τὸ ἐρυθρόν, διὰ δὲ τοῦ μικροφωτομέτρου τύπου Joyce - Loeble τοῦ Κέντρου Ἐρεύνης Ἀστρονομίας καὶ Μαθηματικῶν ἐμελετήσαμεν ἐπίσης καὶ τὴν λεπτὴν ὑφὴν τῆς δομῆς τοῦ γαλαξίου.