OPTICAL FEATURES ASSOCIATED WITH THE EXTENDED HI ENVELOPE OF M83.

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Abstract.
Deep red Schmidt plates (127-04 + RG630) of the galaxy M83 show the presence of extensive faint optical structure well beyond the Holmberg radius of the galaxy.Digital processing has been used to bring these features out in detail.They consist of arc-like structures and clumps of H II regions,which seem to follow the H I distribution and thus are likely to participate in the warping of the H I disk.

Observations and results

The galaxy M 83(=NGC 5236) is a bright Suothern Sc/SBb I-II galaxy seen nearly face-on (i=24°).It shows a very large H I envelope as was found by Rogstad et al.(1974).Huchtmeier and Bohnenstengel (1981) found that this envelope extended at the sensitivity of their observations, out to about 4-5 Holmberg radii of M 83.The neutral hydrogen velocity field can be quite well represented by a warped disk (Rogstad et al.1974). We have obtained two deep red exposures of the galaxy to search for faint optical extensions.The plates were taken with the ESO-Schmidt telescope at the La Silla Observatory.

Inspection of the plates showed the presence of very faint features fairly far away from the main body of the galaxy.To bring these details out more clearly,a sizable portion (10*10 cm) of the plates was digitized at the JPL Image Processing Laboratory.Various forms of processing were applied to the data (see also Lorre,1981).No calibration was available at the telescope when the plates were taken,so the actual brightness of the features is undetermined.

Qualitatively , the following was found:

1). When considering progressively fainter levels,the shape of the main disk grows from nearly circular to more irregular.The asymmetry of the disk changes orientation with fainter brightness levels.
2). Far to the north of the galaxy (r≈40 kpc),a faint partial circle or spiral arm can be traced over a distance of ∼ 35 kpc. The width of this feature is ∼ 5 kpc (Feature A).

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3).To the NW,closer in ($r \approx 30$ kpc),a somewhat longer (~ 50 kpc) and thinner ($\lesssim 3$ kpc) arc is easily distinguished (Feature B).
4).At variuos distances from the main body clumps of what appear to be H II regions are present.These are confined to the H I envelope (especially the so-called H I finger towards the South of the galaxy).
5).A rather drastic difference in the background level between the SW and the SE side of the galaxy seems present.The reality of this and its association with M 83 can however not be unambiguously established.

Some of the above,especially Feature A,appear to represent a diffuse stellar population,Others are most likely H II regions.Both feature A and feature B occur at the edges of the H I distribution as maesured by Rogstad et al.($N_{H\ I} > 1*10^{20}$ atoms cm^{-2}).Feature A is a direct extension of the large H I counterarm,while feature B delineates the outer edge of the steep H I gradient at the NW side of the galaxy. Although no velocities have been determined for the optical features, the close correspondence between the optical and the H I distribution makes it very likely that the optical material participates in the warping shown by the neutral hydrogen.

These results indicate that at least in the case of M 83 the warping process is not restricted to the cold gas solely.The presence of H II regions and a diffuse stellar population would be in conflict with the concept that star formation stops rather abrupt when the H I column drops below a certain minimum value.Of course,it is very well conceivable that external influences have caused the formation of both the outer neutral hydrogen and the stellar material discussed here.

References:

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