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# Coincidences *

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**Abstract:** The three-armed spiral galaxy AM2006-295, which appears to have an object with an exess recession velocity of 22000 km/s in (behind?) the middle of the third arm, has been observed both in narrow-band imaging and in spectroscopy. Additional evidence of the strangeness of that object is presented.

## 1 Introduction

The whole subject of gravitational lensing gives additional support to the hypothesis that the redshifts of extragalactical objects are of cosmological origin. This "hypothesis" however, has been attacked for some year by a small number of scientists, mainly on the basis of examples of apparent connections or interactions between objects with very different redshifts.

Among the many objects with discordant redshifts presented in the highly controversial book "*Quasars, Redshifts and Controversies*", by Halton Arp (1987), we were especially puzzled by the object AM2006-295, which was first studied by Arp (1982).

This peculiar object looks like a three-armed spiral galaxy, with the third arm originating from a point midway out along one of the other arms. In the middle of this third arm, there is a bright knot, with an excess redshift of more than 22000 km/s with respect to the spiral galaxy which, itself, has a recession velocity of 7000 km/s (Fig. 1).

The more common interpretation would be that the high redshift object lies behind the spiral galaxy, the apparent association being due to a projection effect. The usual counter-argument is that three-armed spiral galaxies are so rare – and this one is even peculiar in not having the third arm originate from the bulge – that the probability of finding a higher redshift object right in the middle of the abnormal arm is vanishingly small. However, the validity of such *a posteriori* probability calculations is – at least – doubtful. Nevertheless, we felt that the object looked sufficiently interesting to deserve further independent investigation. In particular, our aim was to investigate more closely the nature of the "third arm", and to analyze its possible connection to one or the other of the objects.

*Based on observations carried out at the European Southern Observatory (La Silla, Chile).

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Figure 1: Image of AM2006-295 taken with the ESO/MPI 2.2m telescope through a V filter. North is at the top, East on the left. The field corresponds to $\approx 55'' \times 80''$.

The first observations were carried out at the ESO/MPI 2.2m telescope equipped with a direct CCD camera with a scale of 0.35 arcsec/pixel. In good seeing conditions, we obtained images through narrow-band filters centered on the H$\alpha$ line at the redshift of the spiral galaxy (Fig. 2) and at the redshift of the knot in the third arm (Fig. 3). The exposure times were 30 minutes each and the seeing FWHM of these images amount to 0.8 and 0.9 arcsec, respectively.

While the two "normal" spiral arms appear prominently in the H$\alpha$ light at the expected redshift, with many HII regions delineating their shape, the third arm nearly vanishes, appearing much more diffuse than the other two, and showing no sign of stellar activity. However, it does not appear more clearly at the higher redshift. From these images, it is not clear at all that AM2006-295 is a three-armed spiral. It rather looks like a normal spiral with something else associated (or apparently associated because of a projection effect).

However, Fig. 2 shows that, apart from the HII regions delineating the two "normal" arms, there are two other sets of active regions at the lower redshift. One of these sets originates from the northern (eastern) arm and defines a more or less straight line going through the high redshift knot. This could be considered as a wink at Arp.

The other set is, in our opinion, much more intriguing. It seems to originate from the southern arm, at a point close to the knot – where, incidentally, the stellar activity appears strongest – and defines a curve going exactly towards the higher redshift knot: we call this set of active regions the "*chain*".

Spectra obtained with the ESO faint object spectrograph and camera (EFOSC) at the 3.6m telescope with a 300 Å/mm red grism essentially confirm the conclusions drawn from the narrow-band images, and the findings of Arp (1982). The knot has an absorption spectrum with rather weak emission lines whose intensity ratio is characteristic of HII regions. The active regions in the *chain* look really like HII regions and are at the redshift of the spiral galaxy. Few objects appear at the redshift of the knot. Apart from the knot itself, we could identify only

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Figure 2: Image of AM2006-295 taken through a narrow filter centered on H$\alpha$ at the redshift of the spiral galaxy. The object in the *chain* that shows emission at both redshifts is indicated by an arrow.

one other object at a redshift different from that of the spiral galaxy. This is an emission-line object which is at precisely the same redshift as the knot and lies precisely superimposed on one of the HII regions in the *chain*. It is shown by an arrow in Figs. 2 and 3.

We thus have at least two strange coincidences: (1) the *chain* of active regions at the redshift of the spiral galaxy seems to define a connection between the high redshift knot and the spiral arm and (2) the only other object at the redshift of the knot lies precisely at the same apparent position as one of the active regions in the *chain*.

These *may be* chance projections. However, advocating coincidences or chance projections cannot be considered a satisfactory *explanation* of the strangeness of this (these) object(s). By this kind of argument, all gravitational lens candidates might be rejected as "coincidences".

We consider that the right answer is to get better data about such objects, if possible independently of anybody involved in the controversy. This is exactly what we have done. And, although our data do not allow to solve the problem, they certainly add to the strangeness of the object. The "coincidence" hypothesis is not disproved. However, it is weakened. The only acceptable answer now is to go further: get still better data, and try to understand what happens. A spectrum of the diffuse third arm would be very valuable, as well as good spectra of all objects in the field. Very high resolution images of the surroundings of the knot and of the superimposed HII regions would also, undoubtely, help to better understand this object.

The Universe is full of strange objects. Some of them may turn just as coincidences. Other may hold the key to a more profound understanding of the cosmos. The only attitude which is scientifically defensible is to keep an open mind. Dogmatism – on any side – has never brought progress in science.

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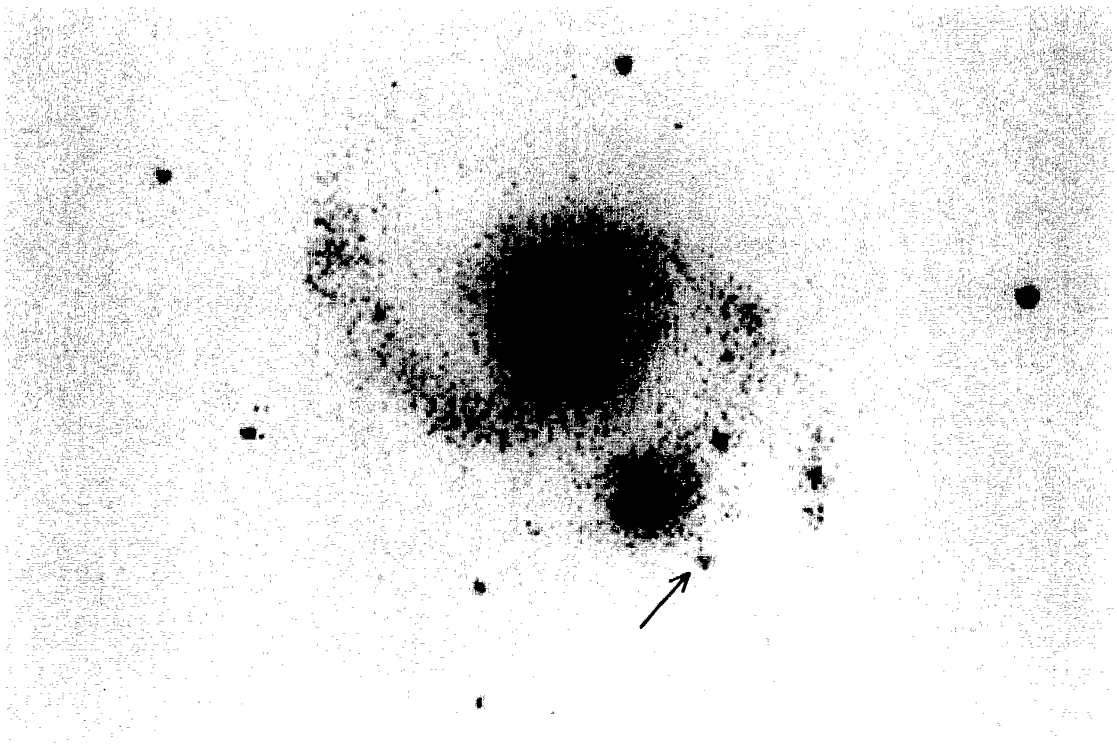

Figure 3: Image of AM2006-295 taken through a narrow filter centered on H$\alpha$ at the redshift of the knot in the "third arm". The arrow indicates the object with both redshifts.

## Acknowledgements

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## References

Arp, H.A.: 1982, ApJ 263, 54
Arp, H.A.: 1987, *Quasars, Redshifts and Controversies*, Interstellar Media, California

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## DISCUSSION

**U.-L. PEN**: Did you take the spectrum of the bright foreground star on the foreground galaxy?

**P. MAGAIN**: Yes, we took a spectrum. Unfortunately, it has a rather low S/N so that we cannot really conclude. The MgI triplet and Na D doublet seem to be present, as well as strange emissions. Further data are needed, and we plan to obtain them.

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