A singular zone in the Universe: proposal of observation

H.H. FLICHE, J.M. SOURIAU, R. TRIAY

Université de Provence et Centre de Physique Theorique, Marseille

September 1982

CPT-82/P.1435

ABSTRACT

This note is an annex of "A possible large-scale anisotropy of the Universe", Fliche et al.(1982), where we show a singular zone (μ) in the spatial distribution of the ALL KNOWN QUASARS.

Subsequent quasar discoveries to March 1981, provided us with other available samples that we utilized in order to test at posteriori the existence of (μ) . These additional data permit to locate it more accuratly in space and to estimate an upper limit of its width equal to 120/h Mpc (h= Ho/100). With the same aim, we put forward a list of 37 objects whose preliminary redshift estimation situated them in the neighbourhood of (μ) and we suggest accurate measure of these redshifts.

POSTAL ADDRESS : C.N.R.S. - Luminy - Case 907
Centre de Physique Théorique
F-13288 MARSEILLE CEDEX 9
France

INTRODUCTION

The singular zone covers an half of the sky and it appears by an absence of quasar in redshift intervals depending of the line of sight which crosses it into the sky; the table 1 locates (μ) in depth.

The cosmological implications and the underlying physical process investigation are not discussed here but they can be found respectively in Souriau (1982) and in Schatzman (1982).

I) CONFRONTATIONS WITH SUBSEQUENT OBSERVATIONS.

In order to verify that it is not a random effect due to the avaible sample of quasars, we have tested it with additionnal data that we collected since March 1981. Our updated catalog, which is as complete as possible, contains 1825 QSO redshifts on about 2000 repertoried objects (including the BL.Lac objects which are not taken into account here and some other objects; high redshifted Seyferts, Markarians..), see Triay (1982).

Since the result of the statistical analysis can be compromised by a single erroneous object which is situated inside (μ) , we keep off from the catalog the unreliable objects. Namely, the redshifts given as doubtful by the authors of the observation and those estimated only by an objective prism techniques (OP). In fact, from OP or GRISM technics, the misidentifications with stars or wrong emission line identifications cannot be excluded. In the other hand, the redshift accuracy for probable (more than one detected emission line) OP quasar candidates ($dz \simeq 0.04$) is not negligible in comparison of the range of the redshift interval corresponding to (μ) which extends from dz=0.04 (for z= 0.9) to dz=0.20 (for z= 3.6), see table 1.

Table 1 :Location of (μ) into the space;

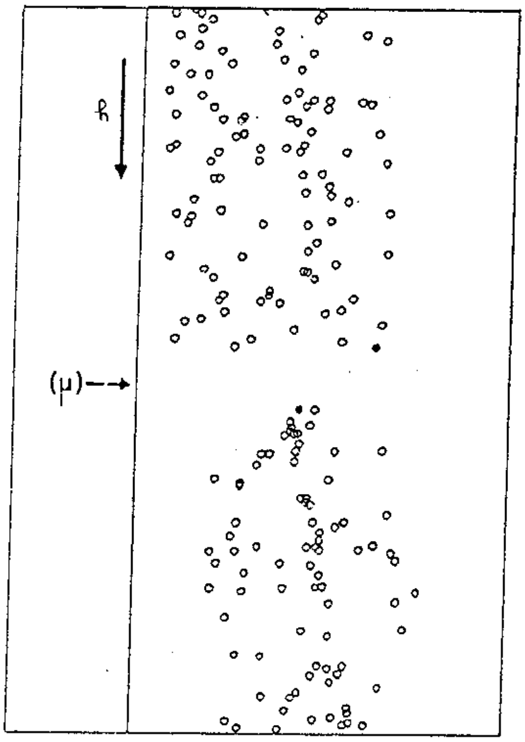
AD	(Z1	Z2)	AD	(Z1	Z2)
00	0.849	0.887	10	0.860	0.898
20	0.894	0.934	30	0.956	0.998
40	1.054	1.100	50	1.203	1.256
60	1.433	1.496	70	1.799	1.881
80	2.415	2.534	90	3.504	3.702

(Z1,Z2) is the redshift interval corresponding to the absence of quasar in several line of sight which are defined by their angular distance A.D. (degrees) from the center of (μ) into the sky: (RA = 17h 45mn Dec = -6 50') ± 15' .

Making use of the reliable objects sample (1268 quasars with certain and accurate redshift to better than 1/100), we estimate an upper limit of the width of (μ) equal to 120/h Mpc (h= Ho/100), the profil of (μ) into the space can be seen in the figure 1.

Figure 1: Profil of (μ) into the space

This diagram represents the spatial (geodesical) distribution of quasars (dots) in the neighbourhood of (μ) from cylindrical coordinates (r,h,φ), the angle φ is omitted. The vertical axis (h-coordinate) is the direction of the anisotropy (the center of (μ) into the sky). One can see a lack of dots in the center of the diagram extending from left (low redshift) to right (high redshift), it corresponds to the singular zone (μ).



This updated sample contains the quasars UM 485 and UM 536 that we did not take into account in our previous analysis because of the same reason discussed above. The previous observation (using OP technic) of UM 485 (z= 2.673), UM 536 (z=2.00) and UM 608 (z=1.51), made by Mac Alpine & Williams (1981), situated them in the neighbourhood of (μ), see Fliche et al. (1982); they were proposed by us, with other five objects, for a more accurate redshift measurement.

These objects have been recently reanalyzed by Peterson and Savage (1982) who found: UM 485 (z=2.684), UM 536 (z=1.985) and UM 608 is probably a star. These two quasars are close to 12 degrees into the sky and they border upon (μ) in front (UM 485) and behind (UM 536); they are denoted by black dots in the figure 1. Thus, the recent observations do not invalidate the existence of (μ).

Remembering that it cannot be interpreted as a result of a particular selection effect in observation, see Triay (1981), the statistical significance of this void can be roughly estimated from the number of quasars situated in the neighbouring bands of the same width (the neighbourhood of (μ)) which is equal to 19+17. This significance is approximatively unchanged in comparison with the previous result.

II) PROPOSAL OF OBSERVATION.

In the directions where (μ) is redshifted at z>1.9, because of the ease for quasar discovering in this range of redshift, the slitless spectroscopy is a powerful method in order to display (μ). For this purpose, the search has to be done at directions more than 70 degrees distant from the center of (μ) into the sky, see table 1. See For instance, the OP quasar survey of Hoag et al.(1977); the spatial distribution of this sample crosses (μ) in the direction RA=22h 45mn, Dec=-40°and offers a visible gap, see Fliche etal. (1982).

Among all known and published quasars that we gathered in the catalog, there are 557 quasars which have not reliable or not accurate enough redshift for this statistical analysis. We find 37 of these objects for which the estimated redshift situated them in the neighbourhood of (μ), as many behind as in front. Nearly all of them are OP quasar candidates, they are listed in the table 2: these follows the name of the quasar, the (1950) Right Ascension and the Declination, the redshift (the parenthesis indicate that it is given as doubtful by the author(s) of the observation), the estimated magnitude, the footnote number, the technic which is used for redshift estimation (OP, GRISM, PDS microdensitometry, IDS, ITS, Spectrograph: see Wills & Wills (1976), the spectral resolution (A), the reciprocal dispersion (Å/mm), the covered wavelength range and the detected emission line (the question-mark indicate that the line identification is not secure).

One expects that as the result of a definite spectroscopic investigation of these objects one would be abble to answer the question on the existence of (μ). In fact, most of the quasars of the table 2 are close enough in the sky (they are situated mainly in two fields; 12 objects in Coma :RA=13h, Dec=27 30' and 15 around :RA=22h, Dec=-20°) and in redshift, so that they could provide us either with a direct observation of (μ) or its invalidation.

Acknowledgements: We thank A. GROSSMAN and D. KUNTH for critical reading of the manuscript.

- T a b l e I -

QSO	- Name	R.A.	Dec.(1950)	Zem	Mag.	Note	Spect.Techn.	Res.	Disp.	Wavelength-range	line ident.
1222-016	UM 498	12 22 46.60	-01 38 08.0	2.44	V=18.5	1	PO	-	1740	3400-5350	Lyα,CIV?
1242+001	UM 516	12 42 50.90	+00 06 46.0	2.05	V=18.	1	PO	-	1740	3400-5350	Lyα,CIV
1255+003	UM 531	12 55 44.20	+00 23 24.0	2.08	V=18.	1	PO	-	1740	3400-5350	Lyα?,OIV?,CIV?
1256+287	COMA 1	12 56 04.10	+28 43 27.0	2.25	B=20.4	9	GRISM and PDS	-	1580	3150-6910	Lyα,CIV
1256+284	COMA 1	12 56 55.70	+28 29 45.0	2.16	B=19.2	9	GRISM and PDS	-	1580	3150-6910	Lyα,CIV
1257+280	COMA 1	12 57 38.50	+28 04 57.0	2.30	B=21.1	9	GRISM and PDS	-	1580	3150-5350	Lyα
1307+181	KP 41	13 07 36.60	+18 09 39.0	(1.90)	V=21.5	2	GRISM and PDS	-	1600	3300-5300	Lyα
1312+275	COMA 1	13 12 17.40	+27 30 40.0	2.09	B=18.8	9	GRISM and PDS	-	1580	3150-6910	Lyα,CIV
1312+270	COMA 1	13 12 46.00	+27 05 56.0	(2.09)	B=21.1	9	GRISM and PDS	-	1580	3150-6910	Lyα?
1313+273	COMA 1	13 13 19.90	+27 20 53.0	2.11	B=19.4	9	GRISM and PDS	-	1580	3150-6910	Lyα,CIV
1316+272	COMA 1	13 16 24.10	+27 13 37.0	(1.93)	B=20.9	9	GRISM and PDS	-	1580	3150-6910	Lyα?
1316+269	COMA 1	13 16 28.40	+26 57 27.0	1.91	B=21.0	9	GRISM and PDS	-	1580	3150-6910	Lyα,CIV
1317+275	COMA 1	13 17 50.20	+27 30 29.0	2.06	B=19.4	9	GRISM and PDS	-	1580	3150-6910	Lyα,CIV,HeII
1318+269	COMA 1	13 18 26.20	+26 55 02.0	1.91	B=19.9	9	GRISM and PDS	-	1580	3150-6910	Lyα,CIV
1318+269	COMA 1	13 18 46.60	+26 55 30.0	1.97	B=18.9	9	GRISM and PDS	-	1580	3150-6910	Lyα,CIV
1318+270	COMA 1	13 18 58.60	+27 02 49.0	2.07	B=19.1	9	GRISM and PDS	-	1580	3150-6910	Lyα,CIV
1338-013	UM 600	13 38 16.00	-01 19 39.0	1.47	V=18.5	1	PO	-	1740	3400-5350	CIV?,CIII?
1426+295	OQ 244	14 26 31.80	+29 32 22.5	(1.421)	V=18.5	3	Spectro.	10-20	240	3200-7000	CIV,CIII?
1435+311	PKS	14 35 11.40	-31 09 29.4	1.287	V=19.	4	?	-	?	?	CIV,CIII,MgII
1435-218	OQ-259	14 35 18.66	-21 51 56.7	1.194	V=17.9	5	ITS	10	-	3800-8000	MgII
1635+630	KP 88	16 35 32.70	+63 05 06.0	1.92	V=20.	2	GRISM and PDS	-	1600	3300-5300	Lyα
1730-130	NRAO 530	17 30 13.59	-13 02 46.3	(0.902)	B=18.5	6	ITS	7 and 15	-	3200-6797 and 4297-8600	MgII
2120-701	PKS	21 20 35.22	-70 10 53.1	1.98	V=19	7	PO	-	?	3200-5400	Lyα,SiIV,CIV
2144+092	OX 074	21 44 42.80	+09 15 51.0	(1.609)	V=17.5	3	Spectro.	10-20	240	3200-7000	CIV?,CIII?
2159-186		21 59 19.70	-18 38 16.0	1.65	B=19.4	8	PO	-	2480	3300-5000	?
2159-192		21 59 45.00	-19 16 19.0	(1.63)	B=18.7	8	PO	-	2480	3300-5000	two lines
2200-182		22 00 14.80	-18 14 30.0	1.59	B=19.6	8	PO	-	2480	3300-5000	?
2201-174		22 01 14.10	-17 29 10.0	(1.63)	B=19.3	8	PO	-	2480	3300-5000	two lines
2201-200		22 01 17.10	-20 03 18.0	1.64	B=19.9	8	PO	-	2480	3300-5000	two lines
2205-187		22 05 48.20	-18 47 31.0	1.64	B=18.6	8	PO	-	2480	3300-5000	two lines
2208-194		22 08 03.40	-19 27 33.0	1.55	B=18.7	8	PO	-	2480	3300-5000	?
2210-190		22 10 56.60	-19 01 50.0	1.66	B=19.3	8	PO	-	2480	3300-5000	two lines
2211-196		22 11 23.80	-19 39 24.0	1.68	B=20.	8	PO	-	2480	3000-5000	?
2214-208		22 14 06.40	-20 48 01.0	1.684	B=18.9	8	PO and IDS	?	2480	3300-5000 and 3700-8500	Lyα,CIV,CIII
2215-213		22 15 02.20	-21 23 07.0	1.59	B=20.	8	PO	-	2480	3300-5000	?
2312-421		23 12 02.02	-42 11 53.0	2.28	B=19.7	10	GRISM and PDS	-	1580	3200-6900	Lyα,CIV
2320-312		23 20 46.95	-31 14 25.2	2.47	V=19.	7	PO	-	?	3200-5400	Lyα,SiIV

=====================================

Notes: FC and Z indicate respectively the references for finding charts and those corresponding to the spectroscopic investigations.

1) Assuming that the line identification is correct, these probable quasars exhibit reasonnably certain emission lines which yelds a redshift to within 0.03. FC,Z:Mac Alpine & Williams (1981)

2) KP 41(z=2.12) and KP 88(z=1.92) were obtained from the direct observation of the transmission grating survey plates used to discover them, see S.W. (1978). Preliminary result; KP 41(Z=1.9?) using a PDS microdensitometer have been published by S.W.(1980). Nevertheless, it seems that the only one detected emission line for these objects, is not yet identified, see V.W.(1980). In the table 2, the redshift is obtained assuming that is Lyα . FC,Z:Sramek & Weedman (1978), Sramek & Weedman (1980) and Vaucher & Weedman (1980)

3) These redshifts are given as doubtfull because of the incomplete line indentification. FC:Grueff & Vigotti (1972), Shimmins et al. (1975) Z:Wills & Wills (1976)

4) The spectroscopic investigation made by Wright et al.(1981) is not yet published, but from the published list of the emission line wavelength one can expect at an accuracy of the redshift (# 0.02) which is not sufficient. FC:Shimmins & Bolton (1974), Savage (1976), accurate optical position by Jauncey et al. (1982) Z=Wright et al. (1981), Jauncey et al. (1982).

5) Any comment is given about the C III line at the expected wavelength 4189 Å. FC:Peterson et al. (1973) Z:Savage et al. (1976)

6) A very steep continuum and only one detected emission line; a possible identification with Mg II. FC:Welch & Spinrad (1973), Kristian & Sandage (1970). Z:Baldwin et al. (1981).

7) Because of the wavelength calibration technic, the redshift is only accurate to better than 0.05. FC.Z:Savage & Wright (1981) Z:Savage et al. (1978)

8) Misidentification with stars are possible for 2159-192, 2201-174, 2201-200, 2205-187 and 2210-190. For 2214-208, three emission lines are visible on the prism plate at 3266 Å (Lyα), 4160 Å (C IV) and 5127 Å (C III)). Two emission lines were detected at 4152 Å (C IV) and 5097 Å (C III) from an individual spectroscopic investigation made by Savage et al.(1978), that yields a redshift z=1.675 and does not agree with the published value z=1.684 (?). In an other hand Mg II would be visible at this redshift. FC.Z:Savage & Bolton (1979).

9) The transmission grating survey plates have been analyzed with a PDS microdensitometer, the procedure is described in Vaucher et al. (1982); if the line identification is correct, the accuracy of the redshift is of the order of 4/100. FC.Z:Hoag et al.(1982)

10) From a slitless spectroscopy, Hoag & Smith (1977) proposed it as quasar (z=2.24, Lyα), but this was not confirmed by Osmer (1982) who used a SIT vidicon spectrometer. The redshift listed in table 2, is given by Vaucher et al.(1982) with an accuracy of 4/100. Because of the discordant interpretation, it is reasonnable to do not consider this value as reliable.

REFERENCES

Argue,A.N., Sullivan,C., 1980 Monthly Notices Roy.Astron.Soc. 192,779
Baldwin,J.A.,Burbibde,E.M., Hazard,C., Murdoch,H.S., Robinson,L.B., Wampler,E.J., 1973 Astrophys.J. 185,739
Baldwin,J.A.,Wampler,E.J.,Burbidge,E.M., 1981 Astrophys.J. 243,76
Fliche,H.H.,Souriau,J.M.,Triay,R., 1982 Astron. Astrophys. 108,256
Grueff,G,Vigotti,M., 1972 Astron. Astrophys. Suppl.Ser. 6,1
Hoag,A.A.,Smith,M.G., 1977 Astrophys.J. 217,362
Hoag,A.A.,Thomas,N.G.,Vaucher,B.J., 1982 "Coma quasars" preprint
Jauncey,D.J.,Batty,M.J.,Gulkis,S.,Savage,A., astron.j. 87,763
Kristian,J.,Sandage,A., 1970 Astrophys.J. 162,391
Mac Alpine,G.M.,Williams,G.A., 1981 Astrophys.J. Suppl.Ser. 45,113
Osmer,P.S., 1980 Astrophys.J. Suppl.Ser. 42,523
Peterson,B.A.,Bolton,J.G.,Shimmins,A.J., 1973 Astrophys.Letter 15,109
Peterson,B.A.,Savage,A., 1982 Priv.Comm.
Savage,A., 1976 Monthly Notices Roy.Astron.Soc. 174,259
Savage,A.,Browne,I.W.A.,Bolton,J.G., 1976 Monthly Notices Roy.Astron.Soc. 177,77p
Savage,A.,Bolton,J.G.,Tritton,K.P.,Peterson,B.A., 1978 Monthly Notices Roy.Astron.Soc. 183,473
SavageA.,Bolton,J.G., 1979 Monthly Notices Roy.Astron.Soc. 188,599
Savage,A.,Wright,A.E., 1981 Monthly Notices Roy.Astron.Soc. 196,927
Schatzman,E., 1982 "Ecole de Goutelas"
Shimmins,A.J.,Bolton,J.G., 1974 Austr.J.Phys.Astrophys.Suppl. 32,1
Shimmins,A.J.,Bolton,J.G., 1975 Austr.J.Phys.Astrophys.Suppl. 34,63
Smith,H.E.,Burbidge,E.M.,Baldwin,J.A.,Tholine,J.E.,Wampler,E.J.,Hazard,C.,Murdoch,H.S., 1977 Astrophys.J. 215,427
Souriau,J.M., 1982 "Ecole de Goutelas"
Sramek,R.A.,Weedman,D.W., 1978 Astrophys.J. 221,68
Sramek,R.A.,Weedman,D.W., 1980 Astrophys.J. 238,435
Triay,R., 1981 these de 3eme cycle CPT/P.1297
Triay,R., 1982 "A catalog of high resdhifts" preprint CPT/P.1378 and C.D.S. Strasbourg (on tape)
Vaucher,B.G.,Weedman,D.W., 1980 Astrophys.J. 240,10
Vaucher,B.G.,Kreidl,T.J.,Thomas,N.G.,Joag,A.A., 1982 Astrophys.J. 261(to appear)
Walter,H.G.,West,R.M., 1980 Astron. Astrophys. 86,1
Wills,D.W.,Wills,B.J., 1976 Astrophys.J. Suppl.Ser. 31,143
Wills,D.,Lynds,R., 1978 Astrophys.J. Suppl.Ser. 36,317
Wright,A.E.,Jauncey,D.L.,Smith,M.H.,Savage,A. 1981 unpublished data