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EVIDENCE FOR POLARIZED RADIATION IN THE FAR INFRARED FROM A SOURCE CONSISTENT WITH THE SOURCE N°24 OF THE HOFFMANN CATALOGUE.

G.DALL'OGLIO, B.MELCHIORRI, F.MELCHIORRI, V.NATALE: TESRE LABORATORY
INFRARED SECTION OF FLORENCE
E.GANDOLFI: INSTITUTO DE ASTRONOMIA Y FISICA DEL ESPACIO, BUENOS AIRES.

Abstract: During a balloon experiment an intense flux of polarized radiation in the 100-2000 microns range has been detected from a source which may coincide with an infrared source listed as N.24 in the 100 microns catalogue of Hoffman.

The balloon-borne polarimeter has been previously described (1,2). During the flight of September 16, 1971 we received a signal at 17 h 42 m 14 s UT with an elevation angle of 8° above the horizon. The signal was about one hundred times larger than the noise of the system. It was received by all the four channels (two channels 90° apart in phase and two derivative channels which cut off all the constant spurious background). The signal was about the

same for all the channels (it appears to be slightly larger in the 90° channel), as shown in fig.1.

The source was detected during various gondola oscillations versus EAST and the celestial zone explored is shown in fig.2.

A signal which may be due to the same source was detected at 17 h 02 m 29 s UT after one hour of flight, when the balloon was at an altitude of about 100 mb. However, at this time the signal appeared to be much smaller and detectable only in the 90° channel.

The position of the source in the sky may be evaluated using the signal from Q-Ophiuchi nebula and from the Sun as references. However, the error in the position results to be quite large because of the field of view of our system ($\pm$0.4°) and because of the precision of the magnetometer ($\pm$ 0.5°). The position results to be consisten with source N.24 of Hoffmann's 100 microns Catalogue (3).

The estimated position of the source is listed in table I together with the measured flux.

T A B L E I

Source	1950	1950	Intensity
N.24 of Hoffmann	17h16m29s	-35° 52'	$1,6 \times 10^{-13}$ watt cm^{-2} (80-130 microns)
observed source	17h16m$\pm$2m	-36° $\pm$ 0,5°	4×10^{-13} watt cm^{-2} (polarized 100-2000 microns)

We should point out that our polarimeter is sensitive only to polarized radiation. Because of this our measurements cannot be directly compared with the Hoffmann one; moreover the band pass of our system is 100-2000 microns while the Hoffmann band is 80-130 microns.

The vibrational plane results to be parallel to the galactic plane within 10°.

If the observed flux may be attributed to the Hoffmann source two facts should be pointed out:

1) a certain amount of radiation is due to wavelengths greater than 100 microns.

2) the polarized signal is high enough to suggest that the radiation is almost enterely polarized.

Both these facts are in agreement with the hypothesis of a radio-continous because the alternative of a thermal emission by grains magnetically oriented is expected to have too poor an efficiency at wavelenghts greater than 100 microns.

However prior to any conclusion, other measurements are required and we should point out that perhaps the source is detectable by ground based observatories in the atmospheric windows.

Reference

1. - G.Dall'Oglio,B.Melchiorri,F.Melchiorri,V.Natale,and E.Gandolfi; Infrared Physics,accepted for Pubblication,1972.

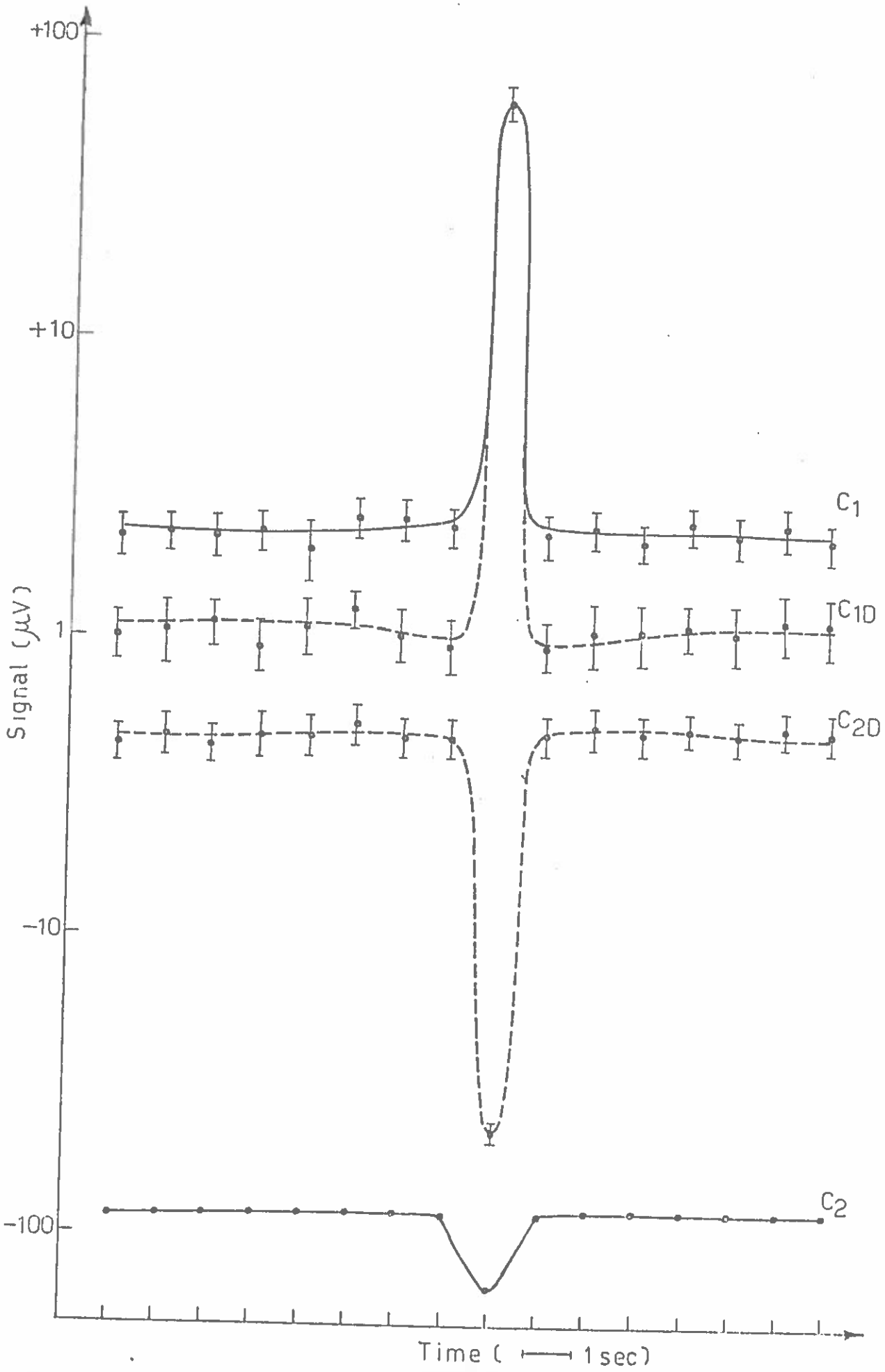
2. - G.Dall'Oglio,B.Melchiorri,F.melchiorri,V.Natale,and E.Gandolfi; in preparation.

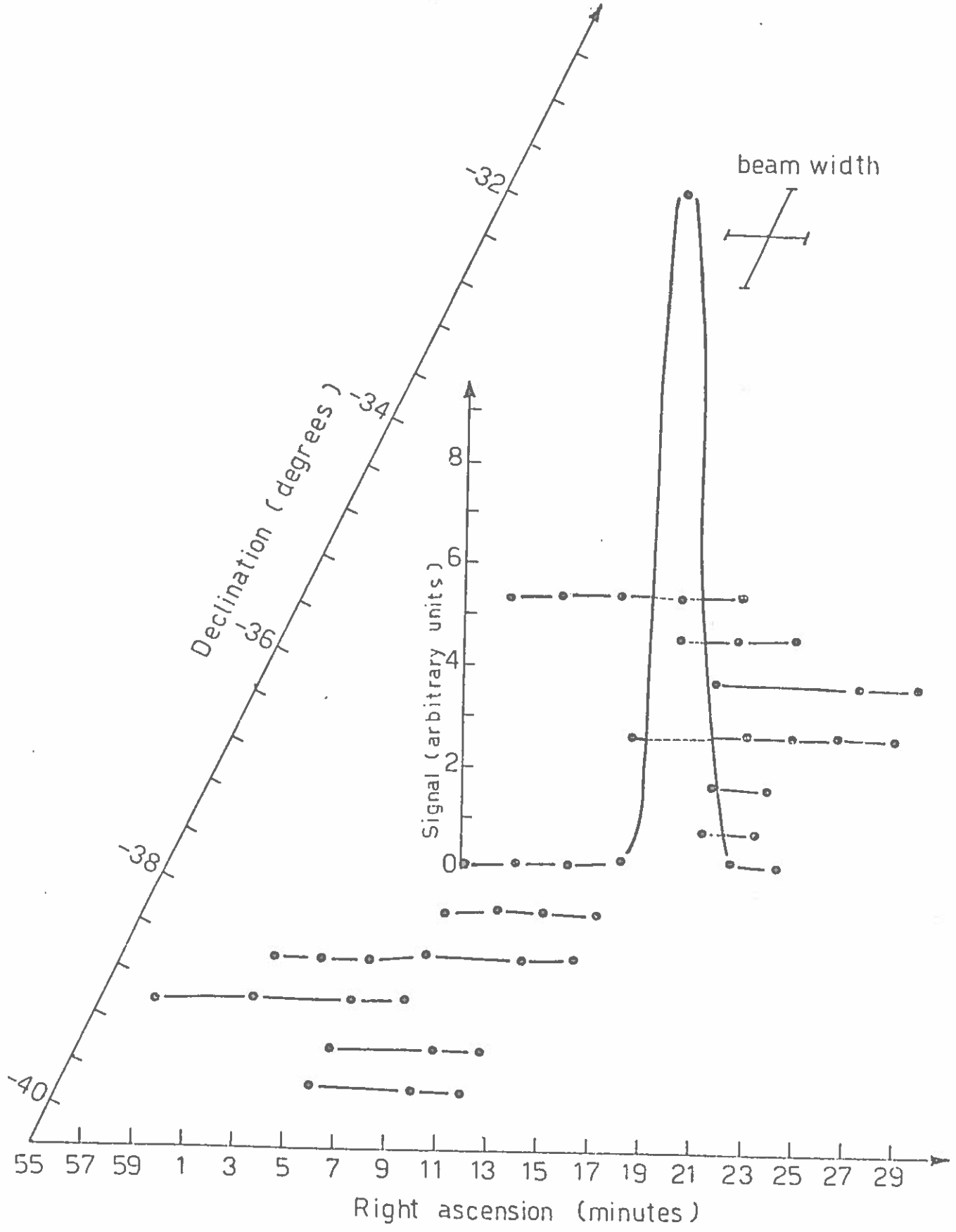
3. - W.F.Hoffmann,C.L.Frederick,R.J.Emery;I972,Ap.J.(Letters)L92

Figure captions

Fig. 1: Signal due to the source transit: the channels C1 and C2 are 90° apart in phase in order to measure the position of the vibrational plane. The channels C1D and C2D are "derivative channels"; that is they are insensitive to signals slower than 10 sec.

Fig. 2: the zone of the sky explored just before and afeter the detection of the source. The variations in declination are produced by continuosly tilting the polarimeter between -40° and -15°: the variations in right ascension are random and are due to the gondola oscillations.


+100
+10
1
-10
-100
Signal (μV)
C1
C1D
C2D
C2
Time (1 sec)


beam width
-32
-34
-36
-38
-40
Declination (degrees)
8
6
4
2
0
Signal (arbitrary units)
55 57 59 1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
Right ascension (minutes)