



**Fig. 2** The flux of photino-initiated muons underground when the photino flux is as shown in Fig. 1, for gluino mass  $M = 2$  GeV, two squark masses, and  $(\tilde{\gamma}/\gamma)(\mu/\tilde{\gamma}) = 0.1$ , as a function of slant depth (given in m water equivalent).

(refs 9, 10), but would result in 12 events per year in the proposed undersea detector, DUMAND.

Sources other than Cyg X-3 may be more promising. For example, Hercules X-1 has now been confirmed as a strong source of  $\gamma$  rays from 1 TeV (refs 26, 27) to  $10^4$  TeV (ref. 28) LMCX-4 has also been observed at the highest energies<sup>29</sup>, and is far enough away for there to be substantial  $\gamma$ -ray attenuation.

Thus, it is not inconceivable that photinos, if they exist, will be observed from astronomical bodies. However, this discussion shows that there are certain requirements if this is to happen in the near future. First, the source must have a proton luminosity close to its astrophysical limit. Second, there will have to be conditions between us and the source which reduce the flux of  $\gamma$  rays; otherwise, much higher fluxes would exist than is evident. Third, the gluino and squark masses must be close to the current experimental limits.

Let us consider the last point further. The lower limit on squark masses is  $\sim 12$  GeV for charge  $1/3$  and 15 GeV for charge  $2/3$  from  $e^+e^-$  collisions<sup>3,4</sup>. Beam dump experiments place a lower limit on the gluino mass of 4–5 GeV for a squark mass of 10–20 GeV, with lower gluino masses possible for higher squark masses<sup>30,31</sup>.

The observation of monojets with large missing transverse momentum  $p_T$  at the CERN  $\bar{p}p$  collider<sup>32</sup> has received considerable attention as possible evidence for SUSY. If the SUSY interactions except at certain energies where a squark is resurposes) two possible scenarios for gluino and squark masses<sup>33–35</sup>. In the first, each has a mass of  $\sim 40$  GeV and measurable photino rates from cosmic sources can probably be ruled out. In the other, the gluino mass is  $\sim 3$  GeV and the squark mass  $\sim 100$  GeV. This latter case could lead to a significant photino flux from Cyg X-3, but the photino cross-section would probably be too low for atmospheric or underground interactions except at certain energies where a squark is resonantly produced.

However, there is still debate over whether the monojets cannot be given a non-SUSY explanation. If they can, the conventional wisdom is that the gluino and squark masses, for the scenarios discussed above, then become lower limits. But the published data<sup>32</sup> suggest that there may still be an experimental window at low gluino and squark masses where the  $p_T$  carried by the photino is not sufficient for the event to pass the experimental cuts. In that case, gluino production would be large, but the SUSY events would be indistinguishably buried in the huge mass of ordinary data. While this window is small, and there are some theoretical arguments against its existence<sup>36</sup>, it does not seem that it can yet be ruled out experimentally.

In conclusion, measurable levels of photinos from cosmic sources such as Cyg X-3 cannot yet be ruled out by current

theoretical or experimental knowledge. If the anomalous air showers and underground muons reported from Cyg X-3 are confirmed by further observation, then no conventional explanation, including neutrinos, will suffice. A photino explanation would at least not be *ad hoc*.

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- Nanopoulos, D. V. & Savoy-Navarro, A. (eds), *Phys. Rep.* **105**, 1–140 (1984).
- Savoy-Navarro, A. *Phys. Rep.* **105**, 1–140 91–120 (1984).
- Yamada, S. *Int. Lepton/Photon Symp.*, 525–564 (F. R. Newman Laboratory of Nuclear Studies, Cornell University, Ithaca, 1983).
- Komamiya, S. *Proc. Supersymmetry versus Experiment Workshop*, TH.3311/EP.82/63-CERN, 57–63 (1982).
- Samorski, M. & Stamm, W. *Astrophys. J. Lett.* **268**, L17–21 (1983).
- Lloyd-Evans, L. *et al. Nature* **305**, 784–787 (1983).
- Stanev, T., Gaisser, T. & Halzen, F. & Gaisser T. K., *Workshops on Cosmic Rays and High Energy Gamma Ray Experiments for the Space Station Era* (Baton Rouge, Louisiana, 1984).
- Stanev, T. & Ch. P. Vankov, *Proc. 19th int. Cosmic Ray Conf., La Jolla*, 7, 219–222 (NASA, 1985).
- Marshak, M. L. *et al. Phys. Rev. Lett.* **54**, 2079 (1985).
- Battistoni, G. *et al. Phys. Lett.* **155B**, 465–467 (1985).
- Stenger, V. J. *Astrophys. J.* **284**, 810–826 (1984).
- Fayet, P. *Phys. Lett.* **86B**, 272–278 (1979).
- Kane, G. L. & Leveille, J. P. *Phys. Lett.* **112B**, 227–232 (1982).
- Harrison, P. R. & Llewellyn-Smith, C. H. *Nucl. Phys.* **B213**, 223–240 (1983).
- Lee, H. & Bludman, S. A. *Astrophys. J.* **290**, 28–32 (1985).
- Stepanian, A. A. *Adv. Space Res.* **3**, 123–130 (1984).
- Baltrusaitis, R. M. *et al. Proc. 19th int. Cosmic Theory Conf., La Jolla*, 8, 1104–1041 (NASA, 1985).
- Eichler, D. & Vestrand, W. *Nature* **307**, 613–614 (1984).
- Hillas, A. M. *Nature* **312**, 50–51 (1984).
- Chanmugam, G. & Brecher, K. *Nature* **313**, 767–768 (1985).
- Stecker, F., Harding, A. & Barnard, J. *Nature* **316**, 418–420 (1985).
- Kolb, E., Turner, M. & Walker, T. *Phys. Rev.* (submitted).
- Barnhill, M. V., Gaisser, T. K., Stanev, T. & Halzen, F. *Univ. Wisconsin Rep. MAD/PH/243* (in the press).
- Kitamura, T. *Proc. 17th int. Cosmic Ray Conf., Paris* 13, 361–380 (CEN Saclay, 1981).
- Arison, G. *et al. Phys. Lett.* **147B**, 222–226 (1984).
- Dowthwaite, J. C. *et al. Nature* **309**, 692–693 (1984).
- Cawley, M. F. *et al. Proc. 19th int. Cosmic Ray Conf., La Jolla* 1, 219–222 (NASA, 1985).
- Baltrusaitis, R. M. *et al. Proc. 19th int. Cosmic Ray Conf., La Jolla* 1, 111–114 (NASA, 1985).
- Protheroe, R. J. & Clay, R. W. *Nature* **315**, 205–207 (1985).
- Bergsma, F. *et al. Phys. Lett.* **121B**, 429–432 (1983).
- Ball, R. C. *et al. Phys. Rev. Lett.* **14**, 1314–1317 (1984).
- Arison, G. *et al. Phys. Lett.* **139B**, 115–125 (1984).
- Ellis, J. & Kowalski, H. *Phys. Lett.* **142B**, 441–445 (1984).
- Barger, V., Hagiwara, K., Woodside, J. & Keung, W.-Y. *Phys. Rev. Lett.* **53**, 641–643 (1984).
- Reya, E. & Roy, D. *Phys. Rev. Lett.* **53**, 881–884 (1984).
- Ellis, J. & Kowalski, H. CERN-TH.4126/85 (1985).

## The statistical significance of close pairs of QSOs

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Burbidge, Burbidge and O'Dell<sup>1</sup> have proposed a method of statistical analysis of close pairs of quasistellar objects (QSOs) to test the null hypothesis that the redshifts of QSOs are of cosmological origin. Only two close pairs of QSOs were then known, therefore the analysis was inconclusive. Since then a number of close pairs of QSOs have been discovered and the same statistical test can be rediscussed with a greater measure of confidence. Indeed, as we show here, the probability of finding so many close pairs by chance, as required by the cosmological hypothesis, is as small as  $\leq 10^{-4}$ , depending on observational uncertainties.

Close pairs of QSOs have conventionally been placed in three categories, each implying a very different physical interpretation. (1) Pairs with very small angular separation ( $\leq 7$  arc s) but with identical redshifts are interpreted as gravitationally lensed images of a single object; (2) pairs or triplets with similar but not identical redshifts are considered members of a supercluster; (3) pairs with very different redshifts. These are either ignored or considered to arise as a chance projection effect of no physical significance.

Thus, the way in which we treat a particular close pair of QSOs seem to be dictated by the values of redshifts of its two

**Table 1** Close pairs of QSOs with separation <120 arc s and with at least one member a radio source

Sources	Radio catalogue nos	Flux densities (in Jy)	Redshifts	Magnitudes	Separation (arc s)	Refs
0240+011 (BSO 2)	—	—	0.599	18.8	BSO 2-RSO = 96 BSO 1-RSO = 115	7,8
0240+011 (BSO 1)	—	—	1.945	19.8		
0241+011 (RSO)	PKS	$S_{2,700} = 0.122$	1.411	20	54	6, 9, 10
0254-334 A	PKS	$S_{2,700} = 0.37, S_{5,000} = 0.53, 0.42$	1.915	17.00		
0254-334 B	—	—	1.857	16.00	33	6, 11, 12, 13
1038+528	OL 564	$S_{966} = 0.8, S_{1,415} = 0.44$	0.677	17.5		
1038+528	—	—	2.30	18.5	81	6, 14, 15
1211+334 A	ON 319	$S_{408} = 1.65, S_{1,415} = 1.13$	1.598	17.00		
1211+334 B	—	—	1.818	20.5	54	6, 16
1349-439 A	PKS	$S_{2,700} = 0.54, S_{5,000} = 0.76$	?	18.5		
1349-439 B	—	—	0.323	17.50	52	17, 18, 19
1532+016	PKS	$S_{2,700} = 1.08, S_{5,000} = 0.94$	1.42	18.0		
1532+016	—	—	0.310	17.0	113	20, 21, 22, 23
1545+210	3C 323.1	$S_{2,700} = 1.29, S_{5,000} = 0.92$	0.264	16.69		
1545+210	—	—	(1.89)	19.5	5	6, 24, 25
1548+114 A	4C 11.50	$S_{178} = 3.9$	0.436	17.00		
1548+114 B	MC 2	$S_{408} = 2.5$	1.901	19.00	60	6, 26
1721+343	4C 34.47	$S_{178} = 5$	0.206	16.50		
1721+343	—	—	1.80	19.0	78	6, 27
2143-156 A	PKS	$S_{2,700} = 1.11, S_{5,000} = 0.82$	0.700	17.50		
2143-156 B	—	—	2.055	18.50	99	28, 25
2217+087	4C 08.66	$S_{1,413} = 0.16, S_{4,873} = 0.070$ $S_{178} = 2.1$	0.6227	18.00		
2217+087	4C 08.66	$S_{1,413} = 0.20, S_{4,873} = 0.075$	0.2282	18.00	78	6, 17, 10
2320-035	PKS	$S_{2,700} = 0.42, S_{5,000} = 0.39$	1.410	18.60		
2320-035	—	—	2.040	20.60		

members. For example, according to the conventional view, the close pair 1548+114 A,B, with angular separation 5 arc s, is placed in category (3) because its member redshifts 0.436 and 1.901 are very different, whereas the close pair 0957+561 A,B, with angular separation 5.7 arc s and identical redshifts 1.407, is placed in category (1).

This procedure can be defended if the density of the QSO population is such that QSOs with different redshifts (and hence different distances, according to the cosmological hypothesis) are frequently projected close to each other for any randomly chosen observer in the Universe. When the first two pairs were found—Ton 155 and 156, and 1548+114 A,B, with discrepant redshifts and small separations of 35 and 5 arc s, respectively—statistical arguments were given<sup>2,3</sup> to show that their occurrence by chance was very unlikely. However, these results were discounted on the grounds that *a posteriori* computation of probabilities can be misleading.

To avoid such a criticism, Burbidge, Burbidge and O'Dell<sup>1</sup> made *a priori* predictions of the expected number of close pairs arising by accident in any future survey of QSOs. Their expected number of QSOs lying within  $\theta$  arc s of an arbitrary search centre is given by

$$\langle n \rangle = 2.4 \times 10^{-7} \Gamma(< m) \theta^2 \quad (1)$$

where  $\Gamma(< m)$  is the sky density of QSOs brighter than magnitude  $m$ , expressed in units of (arc deg)<sup>-2</sup>. Thus,  $\langle n \rangle = 1$  when  $\Gamma = 1$  and  $\theta = 3,600/\sqrt{\pi}$ . This formula can be applied at any time to decide whether the observed number of close pairs of QSOs is consistent with that expected by chance projection effects.

A search around each centre may be considered a 'trial' and the discovery of a pair a success. If there are  $N$  trials, then the expected number of successes is given by

$$\langle S \rangle = N \langle n \rangle = 2.4 \times 10^{-7} \Gamma N \theta^2 \quad (2)$$

If the cosmological hypothesis is correct, then the probability of observing at least  $r$  pairs in  $N$  such trials can be estimated by using the Poisson distribution. The hypothesis becomes of doubtful validity if the observed number  $r$  is such as to make the probability very small, say  $< 10^{-2}$ .

To avoid the criticism of being *a posteriori*, the choice of  $\theta$  in formula (1) must be *ad hoc*, in the sense that it should not

bear any relation to the close pairs already discovered. In the earlier studies (for example, refs 2, 3), the value of  $\theta$  was equated to the separation of the close pair under investigation, and it was argued that the probability of an event cannot be unambiguously determined after it has occurred, in terms of its observed parameters.

We investigate here the close pairs in which at least one member QSO is a radio source. Table 1 lists all such close pairs of QSOs, excluding those that are accepted as candidates for gravitationally lensed objects. As radio positions used in optical identification usually come with error boxes of sides  $\leq 10$ –20 arc s, the value of  $\theta$  chosen in formula (1) should be large compared with these values. On the other hand,  $\theta$  cannot be too large if our whole purpose is to test whether the apparent closeness is significant enough to warrant physical association between the members of the pair. These considerations suggest that  $\theta$  could be chosen in the range  $\sim 60$ –180 arc s. Here we use  $\theta = 120$ .

We have found a total of 30 pairs with  $\theta \leq 120$  in the literature, of which 6 have almost identical redshifts and are thought to be gravitational lenses. In all the other cases the two redshifts are different.

Because observationally, it is easier to pick out bright pairs, the test is more meaningfully applied for the brighter QSOs. Thus, we arbitrarily set our faintness limit at  $V = 18.5$ , as this value is bright enough for detection and faint enough to ensure enough 'trials' to make the application of formula (1) statistically viable. Although QSO catalogues list the  $V$  magnitudes, the surface densities  $\Gamma(m)$  are generally given for the  $B$  magnitudes. Taking average  $\langle B - V \rangle = 0.3$ , we therefore set  $m = 18.8$ . Studies of surface densities<sup>4</sup> suggest that  $\Gamma \leq 2$  at  $m = 18.8$ . With  $\theta = 120$ ,  $\Gamma = 2$ , formula (2) gives

$$\langle S \rangle = N \langle n \rangle = 7 \times 10^{-3} N \quad (3)$$

What is the value of  $N$ ? Using the criterion specified above,  $N$  is the number of radio loud QSOs brighter than  $V = 18.5$  whose neighbourhoods up to 120 arc s have been carefully scanned for close companion QSOs brighter than  $V = 18.5$ . The total number of QSOs listed in the catalogue of Véron-Cetty and Véron<sup>5</sup> which are radio loud and brighter than  $V = 18.5$  is  $\sim 1,030$ . The corresponding number in the Hewitt-Burbidge catalogue<sup>6</sup> is  $\sim 850$ .

We will set  $N = 10^3 f$ , where  $f$  indicates the fraction of such QSOs whose fields have been searched for close companions out to  $\theta = 120$ .

In practice no such systematic exercise has been undertaken. The optical identification programme does involve a search for an optical candidate near the radio position, but usually such a search is stopped when a source is found within the error box of the radio position. Taking this error box as  $\sim(20 \text{ arc s})^2$ , we note that this is only  $\sim 10^{-2}$  of the total area  $\pi\theta^2 \text{ (arc s)}^2$ . This indicates the value for  $f$ , although we will take it as high as 0.1 (meaning that about 100 radio QSOs have been carefully searched for close pairs out to 120 arc s). We then obtain from formula (2)

$$\langle S \rangle = 0.7 \quad (4)$$

It is clear from Table 1 that there are six close pairs that meet our pre-set criteria. The Poisson probability of obtaining 6 'successes' with a mean of 0.7 is  $\leq 1.3 \times 10^{-4}$ . This probability is too low to support the belief that these pairs arise from the chance projection of cosmologically distant objects in neighbouring directions.

In principle, formula (1) can be applied to optically selected QSOs also. There are four pairs of radio-quiet QSOs of very different redshift with  $V \leq 18.5$  and  $\theta < 120$ . However,  $N$  cannot be estimated very reliably for radio-quiet objects.

Although our analysis indicates that very close pairs of QSOs with different redshifts are physically associated in space, we advocate considerable caution in making this a firm conclusion because of its profound implications for cosmology. The test itself is *a priori* in laying down the prescription in terms of observable parameters like  $\Gamma$ ,  $m$ ,  $f$  and  $\theta$ . However, critics could argue that our chosen estimates of  $\Gamma$  and  $f$  have observational uncertainties. For example, if  $f$  were as high as 1,  $\langle S \rangle$  in formula (4) is raised to 7 and the significance of the result disappears. We do not question this point of view and are happy to record it here because it demonstrates the vulnerability of our approach to observational checks. Whether our estimates and our conclusion are correct can easily be judged when we have better estimates of  $\Gamma$  and  $m$  and after the  $\theta$  neighbourhoods of QSOs have been systematically searched.

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1. Burbidge, E. M., Burbidge, G. R. & O'Dell, S. L. *Nature* **248**, 568-569 (1974).
2. Stockton, A. *Nature phys. Sci.* **238**, 37 (1972).
3. Wampler, E. J., Baldwin, J. A., Burke, W. L., Robinson, L. B. & Hazard, C. *Nature* **246**, 203-205 (1973).
4. Marshall, M. L. *et al. Astrophys. J.* **269**, 42-48 (1983).
5. Véron-Cetty, M.-P. & Véron, P. *ESO sci. Rep.* No. 1 (1984).
6. Hewitt, A. & Burbidge, G. R. *Astrophys. J. Suppl.* **43**, 57-158 (1980).
7. Arp. H. & Sulentic, J. W. *Astrophys. J.* **229**, 496-502 (1979).
8. Wall, J. V., Shimmins, A. J. & Merkelijn, J. K. *Aust. J. Phys., Astrophys. Suppl.* **19**, 1-68 (1971).
9. Shimmins, A. J. & Bolton, J. G. *Aust. J. Phys., Astrophys. Suppl.* **32**, 1-55 (1974).
10. Bolton, J. G., Peterson, B. A., Willis, B. J. & Willis, D. *Astrophys. J.* **210**, L1-L3 (1976).
11. Owen, F. N., Wills, B. J. & Willis, D. *Astrophys. J.* **235**, L57-L60 (1980).
12. Brundage, R. K., Dixon, R. S., Ehman, J. R. & Kraus, J. D. *Astr. J.* **76**, 777-889 (1971).
13. Daintree, E. J. & Walsh, D. *Mem. R. astr. Soc.* **84**, 1-44 (1977).
14. Scheer, D. J. & Kraus, J. D. *Astr. J.* **72**, 536-543 (1967).
15. Gruelf, G. & Vigotti, M. *Astr. Astrophys. Suppl.* **6**, 1-84 (1972).
16. Bolton, J. G. & Shimmins, A. J. *Aust. J. Phys., Astrophys. Suppl.* **30**, 1-54 (1973).
17. Wall, J. V. *Aust. J. Phys., Astrophys. Suppl.* **24**, 1-47 (1972).
18. Wampler, E. J., Gaskell, C. M., Burke, W. L. & Baldwin, J. A. *Astrophys. J.* **276**, 403-412 (1984).
19. Wilkes, B. J., Wright, A. E., Jauncey, D. L. & Peterson, B. A. *Proc. astr. Soc. Aust.* **5**, 2-83 (1983).
20. Schmidt, M. *Astrophys. J.* **151**, 393-409 (1968).
21. Sramek, R. A. & Weedman, D. W. *Astrophys. J.* **221**, 468-480 (1978).
22. Kellermann, K. I., Pauliny-Toth, I. I. K. & Tyler, W. C. *Astr. J.* **73**, 298-309 (1968).
23. Pauliny-Toth, I. I. K., Kellermann, K. I., Davis, M. M., Fomalont, E. B. & Shaffer, D. B. *Astr. J.* **77**, 265-284 (1972).
24. Sutton, J. M., Davies, I. M., Little, A. G. & Murdoch, H. S. *Aust. J. Phys. Astrophys. Suppl.* **33**, 1-44 (1974).
25. Gower, J. F. R., Scott, P. F. & Wills, D. *Mem. R. astr. Soc.* **71**, 49-144 (1967).
26. Pilkington, J. D. H. & Scott, P. F. *Mem. R. astr. Soc.* **69**, 183-224 (1965).
27. Bolton, J. G., Shimmins, A. J. & Wall, J. V. *Aust. J. Phys., Astrophys. Suppl.* **34**, 1-32 (1975).
28. Harris, D. E., Dewdney, P. E., Costain, C. H., Butcher, H. & Willis, A. G. *Astrophys. J.* **270**, 39-47 (1983).

## Shock-induced star formation in G357.7-0.1?

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Recent studies using the Very Large Array (VLA) telescope have revealed the existence of two unusual extended non-thermal sources, G357.7-0.1 and G5.3-1.0 (refs 1, 2). Classified earlier as supernova remnants (SNRs), these sources have a marked axial symmetry and compact sources on the axis at one edge. We have now looked for counterparts of these sources in the Infrared Astronomical Satellite (IRAS) Point Source Catalogue and find an IRAS source showing the characteristic spectrum of an early type star embedded in a dusty cloud, coincident with the compact source in G357.7-0.1. We propose that the compact object is an O star whose formation was triggered by the shock front of the diffuse radio source.

The two radio sources have recently been studied at wavelengths of 20 cm and 6 cm using the VLA<sup>1,2</sup>. Both have unusual axial symmetry, non-thermal spectra, significant linear polarization and compact sources at one edge on the axis. The compact source near G357.7-0.1 has a flat spectrum with flux densities of  $30 \pm 10$  mJy (ref. 1) ( $60 \pm 5$  mJy; ref. 2) at 20 cm and  $48 \pm 14$  mJy (ref. 1) ( $44 \pm 5$  mJy; ref. 2) at 6 cm. The size of the source is  $\sim 6$  arc s (ref. 3). To understand the nature of the compact sources and their relationship to the diffuse sources, we looked for their counterparts in the IRAS Point Source Catalogue. Although we did not find a source associated with the compact source in G5.3-1.0, we found an IRAS source (17368-3057) within 5 arc s of the position of the compact source in G357.7-0.1. This has also been independently reported by Shaver *et al.*<sup>3</sup>. The coordinates of the IRAS source are RA (1950) = 17 h 36 min 52.1 s and dec. (1950) =  $-30^\circ 57' 17''$ , with the positional error ellipse having semi-major and semi-minor axes of 21 and 10 arc s, respectively, and a position angle of  $106^\circ$ . The flux densities (Jy) in the four IRAS bands of 12, 25, 60 and 100 ( $\mu\text{m}$ ) are 1.67, 6.1, 118 and 232, respectively. The uncertainties in the flux densities in the four bands are 14, 15, 16 and 18%, respectively. The source, being close to the galactic centre, has been processed through the IRAS high source density processor<sup>4</sup>. The point source correlation coefficients for the 12-, 25-, 60- and 100- $\mu\text{m}$  bands are 98, 100, 97 and 100%, respectively. There is no 'weeks-confirmed' small extended source in the neighbourhood. However, the number of unconfirmed (only seconds-confirmed) sources are 1, 4, 5 and 3 in the 12-, 25-, 60- and 100- $\mu\text{m}$  bands, respectively, indicating that the source may not be completely point-like and isolated.

The probability of chance coincidence of the radio and IRAS source is quite small ( $\sim 2 \times 10^{-5}$  from radio source count data of galaxies<sup>5</sup>). The extended source is unlikely to be extragalactic<sup>1,2</sup>. Assuming, then, that it is a galactic object, is the compact source associated with it? To estimate the frequency of occurrence of sources with infrared spectra similar to that of G357.7-0.1, we counted sources satisfying the following criteria: (1) the source must have definite flux density measurements for the 60- $\mu\text{m}$  band and for at least one other band; (2) the 60- $\mu\text{m}$  flux density be  $> 100$  Jy; and (3) the flux density at 60  $\mu\text{m}$  must be greater than that at 25  $\mu\text{m}$ . We counted sources in a rectangular strip centred on G357.7-0.1 and having length and width of  $5^\circ$  galactic longitude and  $2^\circ$  galactic latitude, respectively, and found the source density to be  $3.7 \text{ deg}^{-2}$ . The compact source is seen at the more intense western edge (6 arc min long) of the diffuse source. The probability that the compact source is found along this edge within a strip of width 40 arc s (the same as the major axis of the IRAS positional error ellipse) is then  $4 \times 10^{-3}$ . The fact that the source is along the axis of symmetry further reduces the probability. Thus, it seems unlikely that the compact source is not associated with the diffuse source.

The infrared spectrum of the compact source is typical of an