3. Biron, K.K. *et al. Proc. natn. Acad. Sci. U.S.A.* **82**, 2473–2477 (1985).
4. Daggett, S.G., Gruys, K.J. & Schuster, S.M. *J. biol. Chem.* **260**, 6213–6218 (1985).
5. Ramos, F. & Wiame, J.M. *Molec. gen. Genet.* **200**, 291–294 (1985).
6. Huang, D.P., Cote, G.J., Massari, R.J. & Chiu, J.F. *Nucleic Acids Res.* **13**, 3873–3890 (1985).
7. Inman, R.B. *Biochim. biophys. Acta* **783**, 205–215 (1985).

Gamma-ray spectrum of Chernobyl fallout

SIR—The activity in Oxfordshire due to the plume of radioactive material released from the Chernobyl reactor reached a peak on 2 May[1]. On 8 May we examined the 'Polyfoam' air filters routinely used in our laboratory air supply system and monitored a small but distinct amount of β- and γ-radiation activity. We have measured the γ-ray energy spectrum from the filters using a high-efficiency (40%) germanium detector, shielded from room background.

Figure 1 shows the complex γ-ray spectrum from the filters. The background is due to Compton-scattered γ-rays, which do not deposit their full energy in the detector. An analysis of the full-energy peaks yields a definite identification of 16 radioisotopes, with a further three (weaker) tentatively identified radioisotopes. The activity of each radioisotope is categorized as strong or weak in Table 1. The relative activities for the most prominent isotopes vary significantly from those deduced by Fry *et al.*[1], which serves to emphasise that these coarse filters were not designed to collect fallout products. The measured activity of ~ 2,000 Bq m^{-2} of ^{131}I on each 0.1m^2 filter suggests that ~ 1% of the local iodine activity[1] was deposited by the air flow of 2×10^4 m^3 per day.

Table 1 Relative γ-ray activities of radioisotopes measured in laboratory air filters

Isotope	Relative activity*	Half-life
^{131}I	S	8 d†
^{137}Cs	S	30 yr
^{132}Te	S	3 d
^{132}I	S	2 h
^{103}Ru	S	39 d
^{134}Cs	S	32 yr
^{106}Ru	S	367 d
^{140}Ba – ^{140}La	S	13 d – 40 h
^{136}Cs	W	13 d
^{95}Zr – ^{95}Nb	W	64 – 35 d
^{141}Ce	W	33 d
^{99}Mo	W	3 d
^{144}Ce	W	284 d
^{129}Te^{m}	W	33 d
[^{127}Sb]	[W]	4 d
[^{105}Rh]	[W]	1.5 d
[^{143}Ce]	[W]	1.5 d

*Identified radioisotopes are listed in order of activity. Isotopes with activities greater than 10% that of ^{131}I are labelled strong (S) and those with activities less than 5% are labelled weak (W). † Days.

All of the identified radioisotopes are ^{235}U fission decay products. The criteria for observing a particular fission product in such a simple γ-decay experiment are: (1) the feeding mass chain should have a lifetime ⩾ 1 day and ⩽ 500 yr; (2) the fission yield should be ⩾ 0.5% for the mass chain; (3) the β-decays should significantly populate excited nuclear states which subsequently γ-decay. Using these simple criteria, we find that all of the expected mass chains are accounted for, except masses 133 and 147, whose identifications are made difficult by the complexity of the spectrum.

Most of the activity (70%) will decay over the next month and the levels will approach those measured normally from the natural thorium and radium background. Air-supply filters with greater air flows or greater capture efficiency will have proportionally greater activity.

D.M. PRINGLE
W.J. VERMEER
K.W. ALLEN

Nuclear Physics Laboratory,
Keble Road,
Oxford OX1 3RH, UK

1. Fry, F.A., Clarke, R.H. & O'Riordan, M.C. *Nature* **321**, 193–195 (1986).

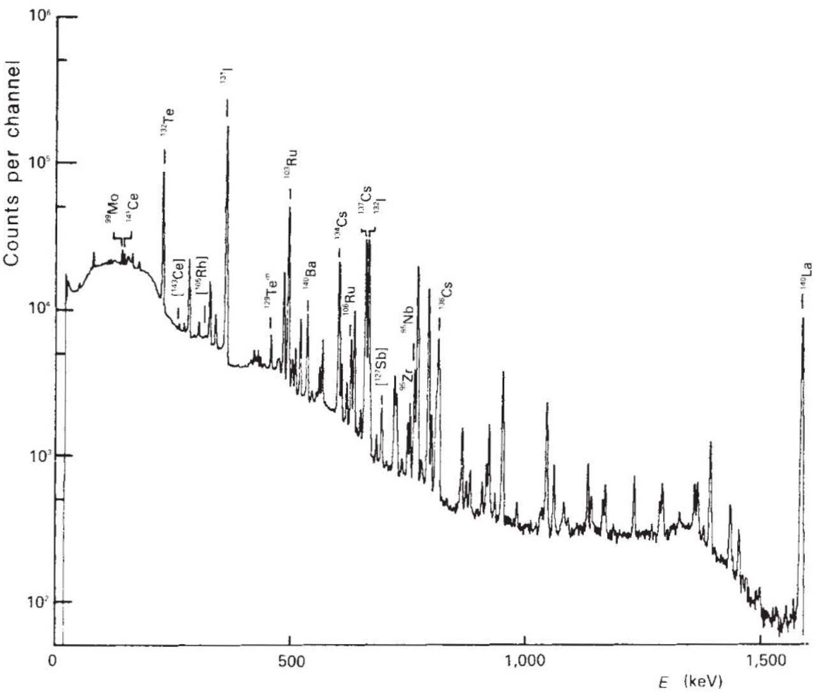

Fig. 1 Part of the γ-ray spectrum obtained with a Ge(Li) detector from a typical air filter. The strongest identified peak of each radioisotope is labelled.

Q1146+111B,C quasar pair: illusion or delusion?

SIR—The quasar pair Q1146+111B,C[1] has been re-observed by Turner *et al.*[2] who argue that it comprises two gravitationally lensed images of a single source. In this letter, we show that we are probably observing two distinct though neighbouring quasars.

Were quasars placed randomly on the sky, the probability of finding another quasar of apparent magnitude m within an angle θ of a given quasar would be[3] $P_r(\theta, m) \simeq n\pi\theta^2$, where $n(m)$ is the sky density of quasars brighter than magnitude m. For Q1146+111B,C, $\theta = 157$ arc s, $n\,(18.5) \sim 1$ per deg^2 (ref. 4), giving $P_r \sim 6 \times 10^{-3}$. However, quasars are probably not distributed uniformly throughout the Universe, and there is evidence that they are clustered in much the same way as are galaxies[5,6] (but see ref. 7), so their two-point correlation function is $\xi\,(r) \simeq (r/r_0)^{-1.8}$, where $r_0 = 5(1+z)^{-1}h^{-1}$ Mpc, $h =$ the Hubble constant $H_0/100$ km s^{-1} Mpc^{-1} and the cosmological density parameter $\Omega_0 = 1$. The probability associated with this excess for a given quasar to have a companion within angle θ brighter than magnitude m is then

$$P_c(\theta,m,z) = 2\pi(1+z)^3 \int_0^{D\theta} \mathrm{d}b\, b \times \times \int_{-\infty}^{\infty} \mathrm{d}l\, \Phi\, \xi\left[(b^2+l^2)^{1/2}\right] \quad (1)$$

where $D(z)$ is the angular diameter distance of the quasar, and $\Phi(L,z)$ is the integral luminosity function for quasars with luminosity $L(m,z)$. Now, $\Phi(L,z) = (\mathrm{d}n/\mathrm{d}z)/D^2(1+z)^{1/2}$ (ref. 8) and observations[4] indicate that for $0.5 < z < 2$, quasars of a given magnitude are uniformly distributed in redshift with $\mathrm{d}n/\mathrm{d}z \simeq 0.5n$. Substitution in equation (1) then gives $P_c(\theta,m,z) = 38(1+z)(\sqrt{1+z}-1)\theta^3\xi(\theta D)\mathrm{d}n/\mathrm{d}z$ for $D\theta \leqslant 2r_0$, where n is per steradian and θ in radians. Numerically, $P_c \sim 2 \times 10^{-4}$.

Published quasar catalogues[9,10] contain $N(19) \sim 2,000$ quasars brighter than $B = 19$. Unpublished surveys probably treble this number. The expected number of random associations with the separation and magnitude of Q1146+111B,C is $NP_r(157 \text{ arc s}, 18.5)/2 \sim 20$, which is roughly what is observed[5,9]. The expected number of closely clustered companions is $NP_c(157 \text{ arc s}, 18.5, 1.0)/2 \sim 1$. Hence we would expect by now to have discovered of the order of one physically associated pair of magnitude 18.5 quasars separated in angle by less than 157 arc s and in velocity by the velocity dispersion of small groups which dominate the correlation function, $\sim 300 \text{ km s}^{-1}$. We should not be unduly surprised if Q1146+111B,C fails tests of the lensing hypothesis[11] — it may be that expected pair.

In conclusion, we suggest that the necessity for lensing in some of the other gravitational lens candidates should be re-examined. This is especially important for faint quasars when there is no independent evidence for lensing (for example, an intervening giant galaxy or distortion of background galaxies) and no sign of common spectroscopic or morphological peculiarities. (Overall spectral dissimilarity need not rule out lensing because quasars can very significantly in the time delay between two images.) The quasar pairs Q2345+007A,B (ref. 12) and Q1635+267A,B (ref. 13) in which the fainter quasars are both roughly magnitude 21 both give $P_c \simeq P_r \sim 2 \times 10^{-4}$, if we assume that the correlation function is valid for proper distances ~ 20 kpc (as it is for the galaxy–galaxy correlation[14]; it has been suggested that the quasar–galaxy correlation function is even higher[15,16]). It is therefore not unreasonable that these two pairs comprise distinct objects; since $P_r \sim P_c$ we should expect to find a few similarly separated quasars with discrepant redshifts, for example, Q1548+114A,B (ref. 17).

We thank Ramesh Narayan for helpful suggestions. We acknowledge support by NSF Presidential Young Investigator grant AST84–51725 and grants from the Exxon Education Foundation and Boeing Company (E.S.P.) and NSF grant AST84–15355 (R.D.B.).

E.S. PHINNEY
R.D. BLANDFORD

Theoretical Astrophysics,
130–33 Caltech,
Pasadena,
California 91125, USA

1. Arp, H. & Hazard, C. *Astrophys. J.* **240**, 726–736 (1980).
2. Turner, E.L. *et al. Nature* **321**, 142–144 (1986).
3. Burbidge, E.M., Burbidge, G.R. & O'Dell, S.L. *Nature* **248**, 568–569 (1974).
4. Marshall, H.L. *et al. Astrophys. J.* **283**, 50–58 (1984).
5. Shaver, P.A. *Astr. Astrophys.* **136**, L9–10 (1984).
6. Kruszewski, A. Princeton Observatory preprint (1986).
7. Webster, A.S. *Mon. Not. R. ast. Soc.* **199**, 683–783 (1982).
8. Weinberg, S. *Gravitation and Cosmology* (Wiley, New York, 1972).
9. Véron-Cetty, M.P. & Véron, P. ESO Scientific Report No. 4 (1985).
10. Hewitt, A. & Burbidge, G.R. *Astrophys. J. Supple.* **43**, 57–158 (1980).
11. Blandford, R.D., Narayan, R. & Phinney, E.S. *Astrophys. J. Lett.* (submitted).
12. Weedman, D.W., Weymann, R.J., Green, R.F. & Heckmann, T.M. *Astrophys. J. Lett.* **255**, L5–L9 (1982).
13. Djorgovski, S. & Spinrad, H. *Astrohys. J. Lett.* **282**, L1–L4 (1984).
14. Lake, G. & Tremaine, S. *Astrophys. J. Lett.* **238**, L13–L16 (1980).
15. Stockton, A. *Astrophys. J.* **257**, 33–39 (1982).
16. Hutchings, J.B. & Campbell, B. *Nature* **303**, 584–588 (1983).
17. Shaver, P.A. & Robertson, J.G. *Mon. Not. R. astr. Soc.* **212**, 15p - 20p (1985)

Beware the cups that cheer

SIR—Aluminium toxicity, intoxication or accumulation is associated (not necessarily causally) with several conditions including dialysis encephalopathy[1] and osteomalacia[2], the amyotrophic lateral sclerosis of Guam, and Alzheimer's disease[3] (believed to account for some one third of a million UK sufferers from senile dementia and said to affect over two million people in the United States). Edwardson and his colleagues have recently shown[4] the presence of aluminosilicates in senile plaques in Alzheimer's disease. Dietary intake of aluminium has not generally been regarded as a hazard, though one Swedish study[5] showed that cooking rhubarb in aluminium saucepans mobilized a significant amount of aluminium, presumably complexed by oxalate (ethanedi-oate). We would like to suggest that attention is paid to the high aluminium content of tea leaves and their infusion.

The tea bush (formerly *Thea sinensis*, now *Camellia sinensis*) is grown on acid soil, and tolerates high levels of aluminium, accumulating great quantities[6] of it. Indeed, potassium alum is used as a fertilizer[7]. The only other food plant which tolerates such high aluminium levels is the cranberry. The tea bush accumulates aluminium in the leaves to enable it to overcome a high level of aluminium in the leached acid soils in which it thrives.

We have examined samples of Chinese, Indian and Russian tea bought as packets from a local supermarket. The X-ray powder picture of each dry ash (all of surprisingly good quality) was essentially that of α-alumina (Al_2O_3). Other weak lines were present. The aluminium content (by gravimetric analysis) of these dry ashes varied from 8,700 p.p.m. to 23,000 p.p.m., in line with several reported analyses; up to 20,000 p.p.m. Al/dry weight have been reported in mature leaves[8].

We infused the teas in a teapot for up to 30 minutes using Cardiff tap-water (very soft), then analysed the infused liquids for aluminium with gravimetric references to underpin routine atomic absorption measurements. A typical finding was that the infusion of Russian tea had about 100 p.p.m. aluminium (100 mg dm^{-3}), and the Indian and Chinese typically had 40 and 60 p.p.m. aluminium, respectively.

Since many Britons drink a litre of tea a day, tea is likely to be as great a source of aluminium as any other in the British diet. (The aluminium foil often used for lining tea chests seems unlikely to exacerbate the problem).

Assuming (in the absence of information on the transfer of aluminium from diet into organs) that any source of aluminium is to be avoided at least for those suffering from conditions related to high aluminium levels, the belief that tea is a sovereign remedy under all circumstances may need revision. "The cups that cheer but not inebriate", may not be as true as William Cowper thought in 1785.

A.-M. CORIAT
R.D. GILLARD

Department of Chemistry,
University College,
Cardiff CF1 1XL, UK

1. Alfrey, A.C., Hegg, A. & Creswell, B. *Am. J. clin. Nutr.* **33**, 1509-1516 (1980).
2. Parkinson, I.S. *et al. Lancet.* **i**, 406-407 (1979).
3. Crapper, D.R. McLauchlan, S. & de Boni, V. *Neurotoxicity* **1**, 3-16 (1980).
4. Candy, J.M. *et al. Lancet* **i**, 354-357 (1986).
5. Mattsson, P. *Vår Foda* **33**, 231-236 (1981).
6. Ellis, R.T. *Biologist* **30**, 247-258 (1983).
7. Eden, T. *Tea* (Longmans Green, London, 1958).
8. Talibudeen, O. & Sivasubramanian, S. *J. Sci. Food Agric.* **22**, 325-329 (1971).

Frequency of dizygotic twinning

SIR—I am puzzled by a calculation in J.M. Diamond's article "Variation in human testis size" (*Nature* **320**, 488; 1986). In it he states that a single ovulation with intercourse will result in a live birth with probability 1/4 and therefore a double ovulation will result in dizygotic twins with probability 1/16. He concludes that the double ovulation frequency must be 16 times the observed dizygotic twinning rate among births.

This conclusion is incorrect since a large fraction of the double ovulations will not lead to any birth at all. A double ovulation will yield zero births with probability 9/16, one birth with probability 6/16 and two births with probability 1/16. Hence the probability that a double ovulation will yield twins conditioned on there being any birth at all is $(1/16)/(1/16+6/16)=1/7$. Therefore Diamond should conclude that the double ovulation frequency is 7 times the observed twinning rate. Thus, for example, the Yoruba women would have a double ovulation frequency of 34.3% rather than 78%, as stated.

MICHAEL SIPSER

Department of Mathematics,
Massachusetts Institute of Technology,
Cambridge, Massachusetts 02139, USA