

MONDAY 9 JUNE 2003

PROFESSOR PAUL MURDIN, DR HELEN WALKER, MR GUY HURST, MR BOB MIZON AND DR CHRIS BADDILEY

Q1 Chairman: Can I welcome you. There is quite a team in front of us today, so it is going to be difficult to control, I am sure. I say that because some of your faces are very familiar to us. You gave us a great time. You showed us the stars at the Royal Observatory the other night and back again after that. Mr Guy Hurst has joined us and Professor Murdin, and I am sure they will have lots to tell us too. Can I say it was really a great trip, we learned a lot and we thank you for turning up and keeping us informed and getting us enthusiastic, so this is a good follow-up to the day. I do not know how you want to answer, but we may direct the question to one of you or two of you, but you are all very free to just say if you would like to come in. I will start off and lob something in to you here about the Government stating that most leading-edge telescopes are abroad, and the 'impact of light pollution in the United Kingdom they say on professional astronomy is therefore minimal'. Do you agree with that statement? Helen, please, I can see you have got one already.

Dr Walker: Certainly it is true that most of the professional facilities that we now use—the large facilities that the UK has funded—are abroad but, of course, a lot of the UK universities do astronomy. We have about 100 universities in the UK and about half of those offer larger or significant modules in astronomy at undergraduate level, and about 25 of them offer postgraduate courses. There are actually about 30 observatories attached to universities in the UK and they are a very valuable teaching tool. Of course, in addition to that, I think the role of the amateur astronomer cannot be underestimated in this regard. A lot of people come to science—not just astronomy—because they have seen the night sky, they have been to amateur observatories and they have been to public viewing evenings at public observatories. There is a lot of excitement there and it fuels all the way through the system, because people can actually do astronomy in the UK.

Q2 Chairman: What about light pollution and the Government's view on it? What do you think about their attitude to it? Are they serious?

Dr Walker: I think the issue of light pollution in the UK is serious. There are things we can do about it now, and I think it would be excellent if this Committee would take forward some of the recommendations that are being made, because we are not saying that lights should go out, we are saying that if you manage to control the lighting, you have light fit for purpose, shining in the right place, at the right time, that will not impact significantly on the astronomy that is done in the UK. You can protect certain sites by using a sort of higher grade of protection, and when local authorities come to do planning applications they can see what they are going to impact. I think often these days they do not actually know many of the observatories and the facilities there are that are being actively used. So it is a case of trying to catch up later on and saying: "Excuse me, there is an observatory just outside town which is a very valuable source of astronomy. It used to be a very dark area and we used to go there and do a lot of work". Suddenly there is an out of town sports field, shopping mall, warehouse distribution centre, and you have just suddenly lost it. To try and back-pedal and say: "Look, could you now go and redesign your whole lighting system", that is far more difficult.

Q3 Dr Turner: An example already is the environmental impact system for any future major development.

Dr Walker: How far does the impact consider? Bob, might I use as an example, which lighthouse, is it?

Mr Mizon: The Farne Islands. The Longstone lighthouse has a 1,000-watts source. It is the brightest lighthouse in Britain, and yet people use half that to light up a back garden.

Dr Walker: That can be seen from 25 miles away. So I do not think environmental impacts often consider large distances, they are very good at considering the local cases.

Q4 Mr Harris: Dr Walker, can I bring you back to the question that the Chairman originally asked. The Government is making a statement here. It is saying that light pollution has no major effect on professional astronomy in Britain, regardless of what amateur astronomers and others have said. As far as professional astronomy is concerned, is the Government right in saying that light pollution has minimum effect on it because most of the professional astronomy work is done outside the country? Do you agree with that?

Dr Walker: I would agree with that to some extent, but professional astronomers—unlike a lot of other sciences—rely on the work of amateurs to support them. We rely on amateur astronomers to spot comets, supernovae and gamma ray bursters. They can be followed-up by UK optical astronomers and these will not be professionals, these will be amateurs supporting us.

Q5 Chairman: So the Government has got the wrong end of the stick, is what you are saying. Just say it, if that is what you think, please.

Dr Walker: No, I think the issue is wider. I think the Government is strictly correct, but the issue is a lot wider. Perhaps we are unique.

Professor Murdin: Could I add something, which might clarify the issue. It is clearly true that if you spend £100 million on a big telescope you want to get the most out of it every hour, every minute of every night that there is. It has to be in the clearest possible place and the conditions have to be the best. There are, say, a dozen such places in the world where this would be true, and we occupy some of them with UK-funded telescopes. To that extent, it is true that professional astronomy at that level needs to be in remote places outside the UK, but there is more to professional astronomy than using the very largest telescopes. There are also people who use moderate-sized telescopes from night to night, from hour to hour and from week to week. Also, there are professional astronomers who are training their students, and it is not practical to take students to Hawaii for a weekend trip to teach them how to use the telescopes. So, for professional purposes, there is also a requirement for access to smaller telescopes within the UK and those telescopes are inhibited

by light pollution, particularly now when it could be equipment that is being put on such telescopes that is advancing in its technological capability and is becoming more sensitive to light pollution.

Q6 Chairman: What would happen if you reversed the light pollution in this country, in terms of professional astronomers, would they return *en masse*?

Professor Murdin: No. They would not return from their mountain top sites, because their mountain top sites are not only stable against light pollution, the atmosphere is stable and all the rest of it.

Q7 Chairman: Right. So what are the other factors?

Professor Murdin: It would particularly enhance the educational experience not only for undergraduates, which is one of the growth areas of physical science education in universities attracting large numbers of people who are, incidentally, learning about electronics and who are, in fact, going to go on to be electronic engineers and so on in their later careers, being attracted into science by studying astronomy.

Q8 Chairman: Can you quantitate in British universities the increase in astronomy interest among students doing courses in it? Can you say what the policy is, for example?

Professor Murdin: No. The typical structure for physical science degrees is that the students will, as it were, major in some mainstream topic like physics, or mathematics, or electrical engineering, or something, but they will bolt-on modules, perhaps for a term, in various astronomical subjects which are things they want to do.

Q9 Chairman: Could that save physics?

Professor Murdin: Yes. In fact, the physics enrolment in the universities has kind of plateaued. It has been declining for a long time, it has plateaued now, but the astronomy education in universities is rising by 10% a year.

Dr Walker: I can actually quantify that because when I went to university back in 1971—

Q10 Chairman: Yes, you do not have to tell us exactly, we can all guess.

Dr Walker:—I did a BSc in astronomy at the University of St Andrews. At that time St Andrews was one of five universities which offered anything in astronomy, either single honours or joint, or a large module. As I say, now we are talking 50 universities having significant modules in astronomy, and this is a great way for students to get into physics and maths.

Professor Murdin: In fact, when I was last interested in this topic, one university every year was adding astronomy into its physics teaching because of its attractive effect on students.

Q11 Mr Dhandra: Can I just take you up on that particular issue, because you say there are lots of universities adding astronomy, as well as the modularisation of university courses. Has there been a significant change in degree courses in astronomy over the last 20 years? Are there more universities offering it as a course now?

Dr Walker: There are certainly more universities offering it as a degree. Certainly when I came into astronomy, places like Leicester, as far as I was aware—speaking as a traditional astronomer—did not do astronomy. Of course, they are now a major centre. There was University College, Edinburgh, Cambridge, St Andrews and Sussex, and these were the major centres.

Q12 Chairman: It does not sound like it is a mickey mouse subject anyway.

Professor Murdin: Certainly not, no. It is one of a high technical content about natural phenomena at a high technical level. Of course, we are talking here not just about undergraduates, we are also talking about postgraduate students, of whom a large number come from overseas to study. We have a great assortment.

Q13 Mr Harris: You mentioned earlier on, Dr Walker, about the importance that amateurs' work plays in the round and in support of professional astronomy. Most people are probably quite unaware of the importance of that. Can you say just a bit more about the specific work that amateurs are expected to do to contribute to the overall knowledge?

Dr Walker: As Paul says, a professional astronomer regards himself as very fortunate if they get one night on a premier telescope at a world-class site, and so that time has to be used incredibly efficiently. Now, when I went out to Australia the stars I was studying faded and when they faded not even the Anglo-Australian telescope could observe them. So we had a group of New Zealand amateurs monitoring all the stars we might possibly want to look at, and they would tell us if one of these stars was going to fade because we would have to reorganise our programme. Variable stars are something professional astronomers cannot follow. The amateur astronomers go out every single night and they look at a whole range—sometimes a hundred—of these stars, and they monitor them night after night after night, and from that we can then apply our sophisticated models and mathematical skills to follow and understand what has been happening. There is no way we would ever get time on a telescope to go back even for five nights, or seven nights. You can do some of these things, but you have to have the amateurs to help you. Of course, it is not like a supernova, or a gamma ray burster, once the amateur has notified us that this has happened, we can then turn our major telescopes on it through the target of opportunity programme to follow it up. There is no way we are going to just scan the skies night after night on the off chance there might be a comet, a supernova, or something else, we have to rely on the amateurs to tell us there is something new.

Mr Harris: At the risk of trespassing on the tabloid agenda and becoming a Lembit Öpik—

Chairman: He is a colleague of ours.

Q14 Mr Harris: Can I ask you about the work—please do not take too much time on this question because it has already been mentioned to us—what amateur astronomers do in terms of identifying these other objects, particularly in view of other objects that may or may not be heading towards us? Would light pollution, in any circumstances, prevent amateur astronomers—who have time to look for these things—from finding any other object? Do you see where I am going here?

Dr Walker: Yes.

Q15 Chairman: Let Guy Hurst answer that.

Mr Hurst: Yes. Just to put it in perspective. Active amateur astronomers are probably observing on about 100-120 nights from the UK, which astonishes our overseas' colleagues, who have better conditions but do not observe anywhere near as much as in this country. On asteroids, we have a number of people who are taking images and trying to measure the positions to determine orbits, which will decide whether or not they are likely to hit us and, increasingly, because they are very faint objects, the light pollution is beginning to make life very difficult.

Q16 Mr Harris: Okay. Thank you. You mentioned the links, but you did not mention them specifically. What are the links between amateur astronomers and professional astronomy organisations? Are they formal or informal? How do you co-ordinate that transfer of information from amateur scientists to professional?

Dr Walker: Guy is probably a better person to answer than I am because the BAA has a good many sections that focus on this, and we trawl their websites and get notified of specific incidents.

Mr Hurst: Yes. I maintain strong contacts with the professions and have done for about 30 years since I was seriously interested in the subject as an amateur. I would say astronomy, of all subjects, has one of the strongest connections between professionals and amateurs. Often professionals ask

me to get a group of people together to observe a particular variable star, as Helen says, for a week, maybe just to run it concurrently with a satellite programme that the professionals are running, and virtually every week there is a PROAM project in progress.

Professor Murdin: Just to embroider on that. The Royal Astronomical Society, which is the senior astronomical society in the UK, counts about 30% of its members as amateurs. It runs an organisation called PROAM, which is a collaboration between professional and amateur astronomers, organising themselves on programmes at work and recording meetings. I was at one three or four weeks ago at the Open University, for example, on meteoroids and so on, and the one before was on exploding stars in the middle of galaxies. So it is regarded by the Royal Astronomical Society as a part of its function to help organise and support such things.

Q17 Mr Harris: Would your average amateur astronomer, by definition, use a home-based telescope rather than travel to an observatory to do the work?

Professor Murdin: Yes, that is right.

Q18 Mr Harris: Have you any idea of numbers in terms of have you measured the number of nights per year that amateurs have gone out doing field work? Have you any idea of the numbers on the ground actually doing that work compared with professional astronomers?

Mr Hurst: I think an amateur to be observing 100 nights-plus, you are talking of 200 or 300 people in the UK. More casual observations once a week or less, maybe you are into 2,000 or 3,000 from my own research. Also, I think we could widen that and say that the popular astronomy magazines, which are sold on the bookstands, have circulations of 30,000-40,000, so there is another layer of very casual astronomers.

Q19 Mr Harris: That is strong for reading matter, is it not?

Mr Hurst: Yes. I know some people read them and do not observe, but there are potentially a lot of people interested.

Q20 Mr Harris: By what factor is the astronomical body in the country expanded by adding in amateurs? Is it two amateurs to a professional? What kind of ratio in your experience?

Professor Murdin: Guy mentioned a figure of 200 or 300 for his own very serious amateur astronomers over a period of time, that is roughly equal to the number of tenured academics in astronomy in the UK. He mentioned a number of several thousand who would perhaps be observing once a week, that would be the whole astronomy population in the UK that makes a living from it, including PhD students.

Mr Mizon: If I can add to that. I was a lone amateur astronomer not affiliated to any group for 20 years before I joined the British Astronomical Association, which has, what, 3,000-plus members.

Mr Hurst: 3,000, yes.

Mr Mizon: So there are many people who do not count themselves as members of astronomical groups. I think we are just the tip of the iceberg.

Professor Murdin: If you are looking at people who are influenced by a first-hand experience of astronomy, you are probably talking tens of millions.

Q21 Mr Key: Following the excellent briefing we had at the Royal Observatory last week, I think the Committee has settled on a list of major offenders of light pollution. One could start with street lighting, motorways, rural roundabouts, floodlighting of churches, sports stadia, domestic security lighting. Have I left anything off that list, and can you prioritise it between you?

Mr Mizon: Golf driving ranges.

Dr Baddiley: That is the one frame I unfortunately skipped, it was there.

Q22 Chairman: Is that in the south of England or north of England or all over the country?

Mr Mizon: I recently travelled from Bournemouth International Airport to Glasgow by plane, I hasten to add, and all the way below me I could see the little orange rectangles with the little line of lights at each end. If they are visible from an aircraft I am sure they are not tremendously well lit.

Q23 Mr Key: Under the Environmental Protection Act 1990 local authorities do have statutory powers to declare a statutory nuisance and to serve an abatement notice. Between you have you ever heard of a planning authority doing that in respect of light pollution?

Mr Mizon: It happens very, very seldom, I would say. There are people who have had action taken by the local councils but the majority of the correspondence I receive as Co-ordinator of the Campaign for Dark Skies is from people who quite simply say that their councils say they cannot do anything or they will not do anything.

Q24 Mr Key: It sounds as if it is "will not" rather than "cannot" in this case. Is it true also that under planning policy guidance notes those who erect, for example, lighting at sports stadia have to include an assessment of the visual impact of the towers on which the lighting rests during daytime but no consideration of the lighting effect at night?

Mr Mizon: Yes, the word "appearance", I am afraid, is used only for daytime appearance.

Q25 Mr Key: So would you welcome new statutory powers for local authorities in respect of light pollution?

Mr Mizon: Most certainly.

Mr Hurst: Security lighting from an observer's point of view is probably the worst peril of all because you need a certain amount of dark adaption to enable you to gain what you can out of the sky and a sudden switching on of a light ruins that for another half an hour.

Q26 Dr Turner: Just to pin this question while we are on this topic. I do not know who, if anyone, is in a place to answer this question but are you aware of whether anybody has done a study of lighting in terms of energy conservation, because clearly there is a massive amount of energy being wasted at the moment and energy conservation is becoming quite important on the political agenda. If it could be demonstrated that you could save seven million tonnes of CO₂ if you re-organised lighting so that you were only lighting the ground and not the sky, and also save a considerable amount of money for council taxpayers, this could be quite a powerful weapon. Does anyone have any information on that?

Dr Baddiley: I have done some calculations and I did check them this weekend because I thought this might come up, it is an important issue.

Q27 Chairman: Perhaps you could submit that to us as well.

Dr Baddiley: I have it written down. In brief, effectively, dealing with light from streetlights only, with 7.5 million streetlights in the UK, the mean power of which is about 100 watts, from that 16% in the traditional type of lamp goes above the horizontal, another 15% is close to horizontal and missing the target completely. If you include all that, the total amount of wasted power is something like 0.33 of a Gigawatt. That is 0.7 of a power station for the UK. You can include other lighting in that, that is just street lights, and the figures go up accordingly.

Q28 Chairman: Has that been published somewhere?

Dr Baddiley: It is based on simple calculations. The 7.5 million figure is the ILE quoted figure. The power station consumption is based on PowerGen.

There are seven power stations operating in the Midlands, so you divide by seven. They do not work to full capacity and I have allowed for that.

Q29 Chairman: It would be very useful to have that.

Professor Murdin: There are studies based on Arizona, for instance, and implementation in their local authorities of good practice for light savings that result for local authorities, and I could provide that.

Dr Baddiley: In terms of greenhouse waste and CO₂ emissions, seven tonnes of carbon dioxide is created in power stations for every kilowatt year of electricity consumption so a one kilowatt light left on—and that is a powerful light admittedly—for 12 hours a night will result in CO₂ emissions from power stations of 3.5 tonnes. A 100 watt light left on all night every night will be producing 0.35 of a tonne every year. Relating that to all the street lighting I have referred to previously, it amounts to 0.4 of a Megatonne per year of CO₂ emissions^[1] that could be saved.

Q30 Chairman: We have all that in your memorandum. Is there anything you can add to that?

Dr Baddiley: No.

Q31 Geraldine Smith: Just to move on to astronomy and education, what contact do the amateur societies, your societies, have with school children and youth groups?

Dr Baddiley: Quite a lot. I myself, like many of my colleagues in astronomical societies, go up and down the country giving lectures in our spare time. We also are involved in things like National Science Week where there is an encouragement to get school children particularly interested in sciences, and astronomy is an excellent way. Many of these kids have never seen a true dark starry night. Bob goes touring with his planetarium, and quite a number of other people do, trying to introduce them to the concept of what the sky can be like and the awe of magic and wonder of the universe really. I give lectures

quite often to the public at all levels. I also run evening classes up to almost university level for the general public, and I do this for free, I do it in my spare time. I am not the only person to do it, there are many others who give up their time because they feel passionately about something.

Mr Mizon: As a full-time planetarium operator I visit hundreds of schools every year. They are nearly all primary schools because of the way the curriculum is constructed. Teachers tell me over and over again that there are two things in primary science that light up the eyes of little children, they are space and dinosaurs. The dinosaurs are gone, they are extinct; the stars are nearly extinct in some places. You might think that in a rural area the children would have a good night sky. I remember going to Dartmoor where I took my planetarium, and there you might think is a dark sky area with small villages. I said to the children, "I bet you get some good stars around here", and a five-year-old said to me, and I wrote it down, "We have lovely stars but when the vicar switches the lights on, they all go away." That is one of the most moving things I have heard. church floodlights; no stars.

Q32 Geraldine Smith: You go round with a mobile planetarium, is it necessary for the school children to see the night sky then or can you not give them a similar experience?

Mr Mizon: Sitting inside a plastic dome with little dots on the ceiling is nothing like sitting below the real night sky.

Professor Murdin: We would not ask that question for sport, would we. We would not say, "Is it okay for children to watch sport on a Saturday afternoon on the TV and not play it themselves." Education is about experiencing things for yourself, not through somebody else's experience of it.

Q33 Geraldine Smith: It is not good enough to have planetariums and computers on line, they must see a dark night sky?

Mr Hurst: I do a lot of teaching and they always want practical observing sessions, whether it is adults or children through to teenagers. Things like

showing them the Milky Way and what used to be the most distant thing—the Andromeda Galaxy—you can see with the naked eye without an optical aid, we cannot do any more and they are really quite disappointed at that.

Professor Murdin: The queues at the University of Cambridge to line up to put their eyeballs to the eyepiece to experience it for themselves rather than watch it projected on the screen is quite extraordinary. People want that first-hand experience. It is that thrill of switching them on.

Mr Harris: There was an excited queue of MPs last week to get a look at the telescope.

Q34 Geraldine Smith: What sort of feedback do you get from youth leaders and school teachers in the schools and youth groups you have visited?

Mr Mizon: I have a stack of thank you letters this high from children, coloured nicely of course, saying: "This is the best day's school I have had for a long time. I wish I could see the stars properly from my garden." It is a very common theme.

Q35 Geraldine Smith: So the children are very excited?

Mr Mizon: If we are talking about feedback I suppose the ultimate is when I began teaching at Poole Grammar School 1971 I had a 60-strong Astronomy Society which I founded and several of those children are now professional astro-physicists and astronomers. If you go back to that school now in the year 2003 you will see ten stars from the car park where we used to observe because the local housing estate has proliferated with globe lights and all sorts of badly directed stuff. If those lights were correctly angled there would still be an Astronomy Society at Poole Grammar School.

Q36 Mr Harris: Of the contact you have with schools, how much of it is in relation to the national curriculum?

Mr Mizon: The national curriculum states that children will study "the wider universe". Just about everything I do is aimed at the facets of the natural

curriculum which children have to know about. Half of it is the earth in space which, of course, is studying our own planet and how it moves around the sun, but they have to know about the solar system and simple constellations like this. If they are not able to look out from their own gardens and see these things there is something very much amiss.

Q37 Geraldine Smith: Finally, what contact do professional astronomers have with schools? Obviously the amateurs do a great job going round exciting children about the subject but what about professional astronomers?

Dr Walker: It is exactly the same, I go out regularly to schools. In fact the place where I work is involved in trying to produce an alternative key stage three for the Solar System and Beyond model using the work that we do with planetary probes—like Beagle 2 and SMART-1 and Rosetta of course. The UK is in an excellent position to blow the children's minds with the work we are doing, so you will find that a lot of professional astronomers love going out to schools and to amateur societies. I speak regularly at amateur societies. For us it is a great deal of fun to meet other people who are just as excited as we are and they do go on and take careers in it.

Chairman: There are five other people who want to ask questions so I am going to have to jump in and curb it a little, not to curb your enthusiasm which comes through.

Mr Dhanda: The Government has proposed non-legislative measures, the statutory nuisance of light pollution that Robert mentioned earlier. Do you think such non-legislative measures could be enough to sort out the problem? I have confused you. Do you think it has to be legislation? Are there other ways of tackling this without legislation?

Q38 Chairman: Do you disagree or are you all of the same view?

Dr Baddiley: I myself believe that the time has come for some legislation. We have tried persuasion, we have tried education. The Government has always been keen that we should educate the public, we have been doing it for 12,

13, 14 years and it is getting worse. The pools of improvement are in a sea that is getting worse, and this will continue. A small example which I think I mentioned the other day in my presentation is that we have managed, fortunately, to get B&Q to promote well-directed, well-designed security lights. It is up to the general public whether they buy them or not. Other chain stores have shown little interest. They have thought about it and done nothing. You can buy ghastly 500 watt security lights in many stores anywhere cheaply and people put them up. You have only got to ask people around are they troubled by neighbours' security lights and they will invariably say yes, and yet they probably do the same thing to the neighbour and this will continue. Without some sort of legislation to control it, it will get worse.

Mr Mizon: They are the new leylandii.

Q39 Mr Key: What was the response of Homebase? You mentioned B&Q.

Dr Baddiley: Homebase said they would look at it when they did their buy for the next year and they would come back to me. The letter is over six months old. They should be well into their buying phase for the winter.

Mr Key: I think I am right in saying that Homebase is owned by Sainsbury's. I wonder if we had better have a word with the Science Minister!

1 *Note by Witness:* Up to 1.2 million tonnes of misdirected street lighting is included [Back](#)

Q40 Chairman: No shares any more, they are on an offshore island.

Dr Baddiley: Focus DIY said more or less the same thing. B&Q is the only one so far that has made a positive move. Again, it is up to the buying public and how they promote them.

Q41 Mr Dhanda: Can you give us some indication as to what kind of quantitative response you have had? Have you put out letters, calls to lots of

organisations and lots of buildings to do something about their lighting, and typically what response do you get?

Dr Baddiley: Usually very little.

Mr Mizon: Over the years the Campaign has corresponded with organisations large and small, with individuals, and lots of the correspondence we get is from people aggrieved by the light trespass from establishments large and small. Most people—and environmental health officers agree with me about this, I have spoken to lots of them—do not realise they are causing a problem to anybody. About 60 or 70% of offenders will do something immediately about the problems they are causing. Of course, there is always the rump who will not do anything and there is very little that one can do to persuade them to take action, and lives are continually blighted because of this. It is not just an astronomer's problem. Millions of people nationwide are troubled by stray light. They feel that there is nothing that can be done about it.

Q42 Mr Harris: Could I ask a supplementary. I am interested in the response that you might get from people where you personally or colleagues have asked neighbours or whatever to turn off the light or change the light specifically. Did you approach that vicar? Have you ever gone to a vicar and said, "Look, these flood lights are . . ."

Mr Mizon: I suggested to the teachers at the school that they should approach the vicar. I do not know whether they did or did not. I have certainly approached my local churches.

Q43 Mr Harris: What happened?

Mr Mizon: One of my local churches was recently heavily vandalised by the light of its own exterior security lamps and I did suggest to them they should amend these either to have a completely dark site or to have the lamps so that they did not shine in too many directions, only shine downwards. They said that they would consider the matter but nothing has happened yet.

Dr Baddiley: This is throughout the country. I was up at John O'Groats hoping to observe the eclipse and our man for Caithness lives right by the cliffs at the edge right at the top and he said he has been troubled considerably by a security light on a farm house and they refuse to do anything about it. That is on Dunnet Head which is about as far north as you can get.

Q44 Dr Iddon: What kind of interaction do you have with local authorities? Do you talk to local authorities in your individual area or the Local Government Association? Can you perhaps expand on that.

Dr Baddiley: We have over 120 local officers throughout the country. Some of these are very active and a few of them manage to actually look at planning applications when they come in to see if there are any serious problems with light. That is the exception to the rule. There are just a few councils that have a lighting clause and in some cases we have persuaded them to do so, but most do not. Where there is a clause at least the plans for the new development have to show the lighting and it has to meet certain minimum requirements on overspill. But what is minimum to one person is not to another. They unusually, for example in my area, allow one lux as being acceptable overspill in new sports lighting. I am an astronomer but I know plenty of people who are not astronomers who find one lux, which is four times moonlight level, quite unacceptable.

Q45 Dr Iddon: Have you tried to engage one of the national associations, the one I mentioned the Local Government Association, to get their interest and get them to pressurise the local authorities?

Dr Baddiley: I have not had any personal dealings with local government besides the Worcestershire Council and also the Malvern Hills District Council which I have had dealings with over a number of years on and off. There are various relationships with various councils. The Civic Society is another possible lever to councils, to local government.

Mr Mizon: There is a complete spectrum of responses from local authorities. Some of them are very proactive, to use this modern word, and some of them seem totally confused by the whole affair. There are hundreds and hundreds of local authorities and, as I say, the response is completely varied and often quite unpredictable.

Q46 Dr Iddon: Do you know of any local authorities which have written guidelines which planning officers use to establish whether the planning application is going to result in pollution of the sky or not?

Dr Baddiley: We do have a list which has been passed on.

Q47 Dr Iddon: That is very useful, thank you, and do you keep a tally of how many local authorities have actually used legislation against light pollution?

Dr Baddiley: We are only 120 local officer strong, so it is a bit difficult to keep the statistics. If we had more members I think we would probably be able to do that sort of thing. Certainly in my own area I know of a few cases where there has been an ordinance and there has been action. There was the Guildford case of a Skybeam where it went through a series of cases and came back to a public inquiry. The finding agreed that the Skybeam was clearly an advertisement, which it clearly was in the first place. Indeed, there are other cases in my own area. The local Ambulance Service decided to illuminate their property and put globe lights round it. Fortunately there was a planning clause already in place which required them to submit their lighting scheme for approval. The council rung me up and asked me if I knew about this. I did not know they had done this, so I put in an objection and they were required to remove the lights and resubmit plans, so it can happen.

Q48 Dr Iddon: I am talking really about known observatories in this country. Do the local authorities who are responsible for those areas notify you that a planning application is going to be considered that might result in pollution of the sky? Is there any requirement for them to do that?

Dr Baddiley: Not that we have heard.

Dr Iddon: None of them do it voluntarily.

Q49 Chairman: We are told that the Czech Republic have legislation. Does it work?

Mr Hurst: I think it is too early to say, it has only just happened. I would add that I have heard in the last few days that a group of astronomers have been invited to the Spanish government for an inquiry like this and they asked if would we support it, so I wonder if there is a certain amount of momentum amongst European governments at the moment towards this issue.

Q50 Chairman: So the jury is still out on whether legislation works?

Dr Baddiley: It is too early.

Mr Mizon: You cannot wave a magic wand.

Q51 Dr Iddon: That begs the question, it is a European issue, so have you ever approached the European Parliament or European members?

Mr Mizon: Yes, in 1993 I went to Brussels to present a petition to the European Parliament and it was rejected on the grounds of subsidiarity. I wrote to Margo Wallström, the European Environment Commissioner, a few months ago and got more or less the same reply.

Q52 Dr Murrison: I am very glad that somebody mentioned leylandii because of course there is a Bill before the House at the moment, the High Hedges Bill. The reason it is before the House is because other remedies have failed. Enforcement action has failed, and civil action has failed in a very common matter. Are you aware of any civil actions that might have been taken by individuals or organisations against offending light sources?

Mr Mizon: The best known case is *Bonwick v Brighton & Hove Council* in August 2000. Mr Bonwick went to court against Brighton & Hove Council, which had erected lights on a neighbouring building which shone very brightly into his premises. Having made a site visit the judge found for him and he

received costs and damages to the tune of several hundred pounds and the lights were ordered to be extinguished until such time as they did not shine into his premises. There is the famous *Stonehaven* case that was more to do with fish than people. Stonehaven Angling Association took the local tennis club to court for shining lights in the river and disturbing the habits of the fish, and again they won their case against very well-organised opposition from the tennis community and the lights were ordered again to be turned on only at specific times re-angled, I believe, and the wattage to be lowered. So there have been cases where light pollution has been seen by a judge to be a nuisance but unfortunately it does not change the law.

Dr Walker: It should be commented that Brighton & Hove Council of course have recently passed light pollution ordinances locally, I think it was in April of this year, and likewise Armagh has considered some local ordinances to alleviate light pollution so people do things and local authorities do try and take action.

Q53 Mr Harris: Does not that mitigate against any possible move by the government to take action? If these local authorities have already taken action does that not undermine the case for legislation?

Mr Mizon: They are only guidelines. Are they enforced? Does anybody really do anything about it? The desperate people who write to me whose lives have been blighted by light pollution very rarely get much action. I know for a fact that in some of those cases the local authority—

Q54 Mr Harris: You say you welcome these ordinances. How can you welcome them on the one hand and then on the other hand say they are not enough?

Mr Mizon: Any move towards positive action on light pollution is welcome but, of course, it just is not enough at the moment. We are drowning in a sea of light and we need more teeth to enforce these so-called guidelines.

Q55 Dr Murrison: The point I was trying to make using the analogy of High Hedges Bill is there has been recognition and legislation to control the nuisance of high hedges, leylandii. Would you see this as an analogous case for legislation or do you think there is any mileage at all in government and local authorities' reliance upon civil actions? From what you say there are cases that have been pursued quite successfully.

Mr Mizon: Most people troubled by light would not go to court about it. They would not risk the expense and trouble of going to court. I think that somebody who is troubled by light, whether or not he or she is an astronomer, ought to be able to find easy redress, just as in the case of noise, vicious dogs, nasty smells. Why should light be any different?

Q56 Dr Murrison: Can I move on and give you a quote from the government who told this Committee that: "It is extremely difficult to design a feasible means of assessing external light for statutory planning control purposes . . . It is therefore highly doubtful that a practical enforcement regime could be based on measurements." That is a bit of a cop-out, is it not?

Dr Baddiley: It is. As I mentioned to you the other day in my own submission, I did try to answer the points on means of measurement, and I think I would have difficulty covering it in sufficient detail in this forum in a few minutes, but there are means of doing it. There are the two issues, light intrusion, the light levels being measured by lux meters extended to millilum which could be achieved with modifications without too much difficulty. Basically putting a lens or mirror in front of them to gather more light. There is the question of the larger global issue of sky glow where a means of measurement would probably involve a photometer that could be built to certain specifications. It is not difficult using standard commercial parts to build a photometer that could monitor, for example, the cloud base, because the cloud base is a mirror to what is on the ground and what is coming up from the ground, directly or indirectly, and that is less critical to atmospheric conditions. Whilst star counting is dependent on the atmospheric conditions at the time. The trouble with star counting is it is a double whammy. You get absorption by the

moisture in the air and scatter from the light caused from the moisture, whereas that is not the case with monitoring the cloud base or just satellite observation. The trouble with satellite observation is it is expensive, it is global and it is not of a sufficiently fine scale to be done locally, but nevertheless it gives the trend and this has been going on for quite some years.

Q57 Dr Murrison: As MPs we all have experience of people having problems with noise and trying to encourage our local authorities to take it seriously. That usually involves an environmental health officer going out with an audiometer. You can measure noise quite easily. It is difficult enough sometimes to get environmental health officers to do that kind of assessment. I would have thought the EHOs' reaction to this sort of thing will be ten times worse. Do you agree?

Dr Baddiley: I think there might be a reluctance. They are probably heavily overloaded with work as it is.

Q58 Dr Murrison: Technically it is possible?

Dr Baddiley: Technically it is possible. It is not difficult to aim a photometer, a luxometer with a modified directional lens at a light and get a reading. That is not difficult and it would give you an absolute reading and that would be quite fine.

Q59 Dr Murrison: Would it not be easier and achieve the same purpose by banning certain sorts of luminaires?

Dr Baddiley: It would indeed. It would be a very sensible approach, I agree. We talked briefly about the Czech law where it is, I believe, now illegal to have a light that is visible beyond a properly boundary under penalty of a considerable fine. It may seem drastic and it is not something that you can introduce suddenly. It is something that perhaps you could introduce over a long period of time so that there is a possibility of people modifying their lights in due time and giving them a timescale to do something about it but, in the

ultimate, something like that which may seem pretty drastic would be 100% effective.

Mr Mizon: A good start would be the phasing out of the 500 watt security light purely from an energy point of view. Even if you do not want to see the stars why have half a lighthouse in your back garden?

Q60 Dr Iddon: One way of getting things rolling in a legislative sense, leylandii and the High Hedges Bill has done that, is through Parliamentary bills, one started in the Lords, one started in the Commons in the current Parliament. My question is have you thought about using Parliamentary processes and encouraging peoples to put down Early Day Motions or to take out a Ten-Minute Rule Bill or, even better, a Private Member's Bill?

Mr Mizon: There have been two MPs who have shown interest in pursuing such courses and they have not finally done so.

Q61 Dr Turner: Just a couple of quickies. First on the question of regulation, is it not simpler rather than trying to measure light levels to regulate by allowing the use of only approved designs of lighting?

Dr Baddiley: I think it might be simpler in the long run, yes.

Q62 Dr Turner: So that is a yes. Secondly, the first-class telescope sites around the world, they must get threatened by light pollution at various times and have to take measures to protect themselves. Can you tell us a little about the measures that they take and tell us whether there is any value in using some of these measures in the United Kingdom?

Dr Walker: Certainly I have seen the Canary Islands Sky Law which is a legal document passed by Royal Decree and that covers telescopes on Tenerife and La Palma and that is a very fierce, very restrictive document because it is a premiere world-class site, one of the best sites in the world and the Spanish people are very concerned to keep it in good order. The legislation does not just cover lights, it also covers industry and things that

might create dust or anything like that so they do not just restrict lighting, they also restrict the actual activities of people. Australia is another case which has very strict laws. These are all international agreements and in all international observatories they are monitored by site directors.

Professor Murdin: The site directors have a light pollution office in all of these observatories and the usual technique is repeated photographs of the landscape around the observatories and repeated measurement of the flux of light from artificial sources that comes into the telescope. I think it might be difficult to carry out the same measurements through telescopes, for example in the environmental health officer sort of context.

Chairman: Thank you very, very much indeed for answering our questions. We will put out a report and perhaps even there will be a debate in Parliament which you can come and listen to. The excellence of that debate will depend on what you have told us here. Thank you very much indeed.