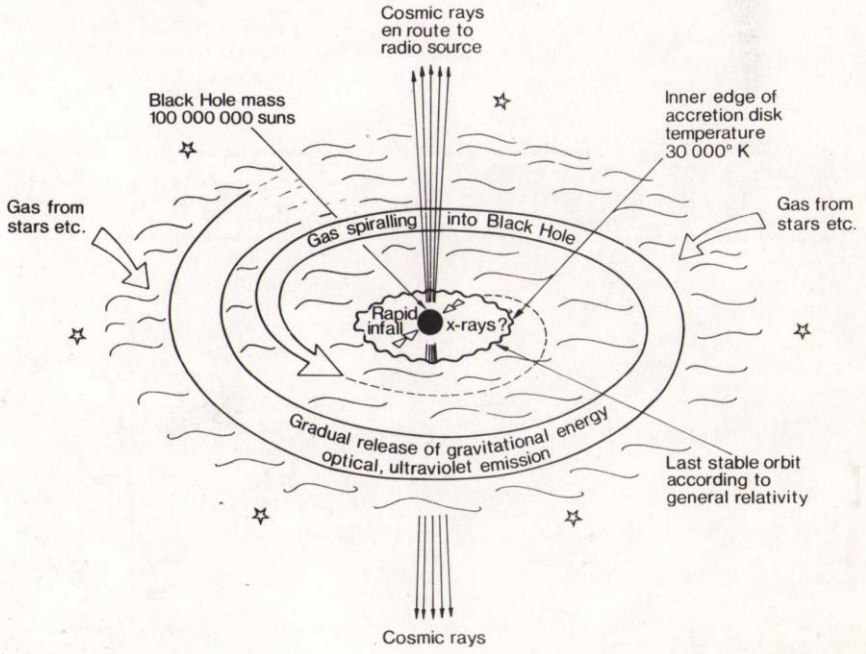
Bulletin
of the Rutherford Appleton Laboratory
8 Nov 1983 No17

IUE 'Weighs' Black Hole

Data gathered by the International Ultra-violet Explorer (IUE) satellite have enabled astronomers to 'weigh' a gigantic Black Hole.

Now in its sixth year of operation, IUE is equipped with ultra-violet sensitive television cameras provided by Appleton Laboratory in collaboration with University College London, which are used to record the faint spectra of stars and galaxies, (see Bulletin No 3 1981). The satellite and cameras, supported by the IUE team at RAL, have performed excellently since launch in 1978 and the long life-time has provided astronomers with a wealth of information about temperatures, motion, composition and density of many celestial objects. It is from this information that astronomers have concluded that the quasar at the core of the galaxy NGC 4151 is powered by a black hole some 100 million times heavier than the Sun.

Using observations, of NGC 4151, the nearest and brightest Seyfert galaxy (a spiral galaxy with a mini-quasar core; a very bright region where gas clouds move at high speed) a small international team from the UK, France, Sweden, Italy and Germany and including RAL's Gordon Bromage as one of its leading members, have investigated the gas clouds close to the galaxy's core. Here they identified three different types of gas cloud, a detailed study of which showed that they moved at different speeds. In a crucial new step they also calculated the distances of these clouds from the core.



Delays give distances

The core's radiation lights up the clouds and it was discovered that there is a delay between core flaring and the clouds becoming brighter. The length of delay thus reveals the cloud's distance from the core. The delays from the three types of cloud turned out to be different. The highest speed clouds responded in about 13 days, meaning they lie some 13 light-days out. The intermediate clouds take about 30 days to respond, and so lie about twice as far out. The slowest-moving clouds show very little sign of being affected by outbursts in the core, and probably lie much farther out, about a light year away from the core. For each type of cloud, an application of Newton's law of gravity to the speed and distance from the central object gives the mass of the latter. All three give very similar answers for the core: about 100 million Suns. Such a large mass in a comparatively small volume can currently only be explained as a black hole.

Theory supported

The observations also support the black hole theory in another, completely independent, way. As the gas spirals into the black hole, it should form into a swirling "accretion" disc. The disc should be at a temperature of 30,000°C, and stretch to about ten times the size of the black hole itself. The inner edge of the accretion disc, where gas is closest to the black hole, is the energetic "powerhouse", producing most of the core's radiation. But the hot gas in the rest of the disc should produce characteristic ultra-violet radiation of its own - and the new observations do indeed reveal radiation of the correct intensity over the predicted range of wavelengths.

This new discovery is regarded as extremely significant as it represents the first direct weighing of a black hole responsible for quasar activity.

Film Badge Notice

It is Period 11. Colour strip RED. Please be sure you are wearing the correct dosimeter and return all old ones.

NEXT FILM ISSUE

Monday 7 November

INTERNAL Events

RAL TECHNOLOGY LECTURE
LECTURE THEATRE - 1500 hrs.

17 Nov Dr R W Newport/RAL
"UK/NL Millimetre Telescope'

ASTROPHYSICS SEMINARS
R61 CONF. RM - 1400 hrs.

16 Nov Dr Duncan B[illegible] AL
'The [illegible]onment of
Come[illegible]ey'
CANCELLED

30 Nov Mr Patrick Wallace/RAL
'Experiences with the Anglo-Australian Telescope'

COMPUTING SEMINARS
ATLAS COLLOQUIUM - 3.15 p.m.

15 Nov Chris Lons/ITV
"Computer Graphics and TV News"

HEP SEMINARS
R61 CONF ROOM - 1100 hrs

9 Nov Dr C T Sachrajda/Southampton
'Baryon Wave Functions and Nucleon Decay'

16 Nov Dr R Marshall/RAL
'Flavour Distillation and its Applications'

23 Nov Dr C H Llewellyn-Smith/Oxford
'Where is Asymptopia for Exclusive Processes in QCD'

CONDENSED MATTER SEMINARS
R3 CONF. RM - 1330 hrs.

15 Nov WIF David/RAL
'Structural Phase Transition in Ferroic Materials'

22 Nov J C Gill/Bristol
'Charge Density Wave Transport Phenomena'

NIMROD SEMINARS
R61 CONF ROOM - 1400 hrs

7 Nov L E Price/Argonne
'Recent Results from HRS at PEP'

14 Nov Julius Wess/Karlsruhe
'Non-linear Realisations of Supersymmetry'

21 Nov M Albrow/RAL
'A Search for Glueballs at the ISR'

HEP TECHNIQUES SEMINAR
R61 CONF ROOM - 1400 hrs

24 Nov Prof D Binnie/Imperial
'Design Experiences and First Results with the TASSO Vertex Detector'

EXTERNAL Events

THEO. PHYS SEMINARS
TPD - Harwell - 1400 hrs

8 Nov Prof K Rzazewski/Warsaw
'Coherence and Saturation Phenomena in the Laser Ionisation of Atoms'

15 Nov Dr Paul Debenham/MRC
'Genetic Engineering - Its Use in Radio-biological Research'

22 Nov Bldg 551 Dr D J Smith/Cambridge
'Applications of Atomic-resolution Microscopy in Materials Science'

SEMINARS IN PLASMA PHYSICS
DEPT. ENG. SCIENCE - OXFORD - 1615 hrs.

8 Nov Dr J B Taylor, FRS/Culham
'The Relaxation of Torroidal Discharges'

15 Nov Dr A B Callear/Cambridge
'Transient Species in Excited Mercury Vapour'

22 Nov Dr J R A Cleaver/Cambridge
'Scanning Ion Beam Lithography'

PHYSICS COLLOQUIA
CLARENDON LAB - OXFORD - 1545 hrs.

11 Nov Prof J M Irvine/Manchester
'The Constancy of Physics and Pre-historic Reactors'

18 Nov Prof H Motz/Oxford
'Making the Deaf Hear - Electrical Stimulation of the Acoustic Nerve'

25 Nov Prof H Rauch/Atominstitut, Austria.
'Neutron Interferometry for Fundamental Physics Studies'

ELEM PART PHYS SEMINARS
NPD - OXFORD - 1430 hrs.

10 Nov Dr A Bodek/Rochester
'Deep-Inelastic Scattering of Electrons from Nuclei'

17 Nov Dr P Herczeg/LASL
'The Manifestations of Right-handed Currents'

ELEM PART THEO. SEMINARS
NPL - OXFORD - 1430 hrs.

11 Nov Prof J H Schwarz/QMC
'Introduction to Superstrings'

25 Nov Dr P Rakow/Liverpool
'Mesons with Gluonic Excitations'

HEP SEMINARS
CAVENDISH LAB - CAMBRIDGE - 1500 hrs.

9 Nov Dr B R Webber/Cambridge
'Jet Fragmentation in QCD'

16 Nov Dr P M Watkins/Birmingham
'Search for Heavy Flavour in the UA1 Experiment at the $\bar{p}p$ Collider.

THEO. PHYS SEMINARS
QMC - LONDON - 1415 hrs.

10 Nov Dr C H Llewellyn-Smith/Oxford
'The Status of Electro-weak Theory'

24 Nov Prof I Percival/QMC
'Order Behind Chaos in Hamiltonian Systems'

HEP SEMINARS
DAMTP - CAMBRIDGE - 1500 hrs

11 Nov M Daniel/RAL
'Chiral Lagrangians and Proton Decay'

PHYSICS IN FOUR DIMENSIONS
DAMTP - CAMBRIDGE - 1615 hrs

10 Nov A Donnachie/Manchester
'Production of Strange and Charmed Baryons'

17 Nov D Richards/Cambridge
'Energy Weighted Cross-sections'

PART PHYS DISC GP MEETINGS
BIRMINGHAM - 1615 hrs.

11 Nov Dr R Cashmore/Oxford
'Recent Results from PETRA'

18 Nov Dr M Albrow/RAL
'A Search for Gluonium States at the ISR'

25 Nov Prof D Binnie/Imperial
'First Results on Heavy Flavour from TASSO'

HEP SEMINARS
MOSELEY TH - MANCHESTER - 1430 hrs

8 Nov Dr Teggart Jones/UCL and Michigan
'The IBM (Morton Salt Mine, Ohio) Proton Decay Experiment'

22 Nov Dr Robin Marshall/RAL
'Flavour Separation in e^+e^- Annihilation and its Applications'

SHEP SEMINARS
SOUTHAMPTON - 1430 hrs.

11 Nov J C Taylor/DAMTP
'Soft Gluons and Fast Quarks'

Queues for SNS

SNS USERS MEETING

More than 100 potential users of the SNS attended a meeting at the Laboratory on 30 September. They came from many different universities and polytechnics and also from our neighbouring establishment AERE. University and polytechnic staff with an actual or potential interest in using neutrons were invited to attend and to bring one of their group,so we had a wide spectrum of participants from new postgraduate research students to Sir David Phillips, Chairman of ABRC, who came in his personal capacity of potential user.

The object of the meeting was to inform users about progress on the SNS and its instruments, plans for the next year leading to the production of the first neutrons in October 1984 and the method of applying for time on the instruments.

Guided tours of SNS were given and detailed information about the various neutron scattering instruments was provided by means of posters. Six of seven authorised instruments will be provided when the first neutrons are available - the seventh has been delayed by financial cuts. These will not all be completed to full design specification, again largely for financial reasons, but all will be well enough advanced for real scientific experiments to begin and will be brought up to full specification over the following year or so. It is worth emphasizing that even at ten per cent of full power, which is expected very rapidly, the SNS will be the worlds most powerful spallation neutron source. A notable feature of many of the instruments is the use of scintillator area detectors developed in Neutron Division which have made a big impact on the instrument design and are about half the cost of an equivalent area of conventional gas detectors.

Three further instruments are being built as development projects and will also be installed for "day one". They each represent areas which require further development either because neutrons or pulsed sources are being used in novel ways. In these cases further technique development will go hand-in-hand with scientific experiments. The total of nine instruments will provide opportunities for scientific research over a wide range of techniques and disciplines and the users response was highly positive and enthusiastic. Each instrument has an Instrument Scientist who is responsible for its construction, commissioning and operation and who acts as Convener of an Instrument User Group, Chaired by a University scientist. These groups will be responsible for selecting the initial experiments and we now confidently expect the user community's enthusiasm to reveal itself in an over demand for instrument time for high quality experiments. This in turn should lead to early demonstrations of SNS's capabilities and hopefully,to the increased funding required to realise its full potential by building up the number of instruments to twenty or twenty five.

RAL TECHNOLOGY LECTURES

The next lecture in this series will be held on Thursday 17 November at 3 p.m. in the Lecture Theatre.

THE UK/NL MILLIMETRE TELESCOPE
by
Dr R W Newport
RAL

The MM Wave Telescope is being constructed jointly by the UK and the Netherlands on the Island of Hawaii. A description of the facility and the current status will be given.

Trade Exhibition

Tektronix will be holding an exhibition of computer graphic equipment including low cost colour terminals, graphic workstations, colour copiers and software.

The venue is R12 conference room and the time 1000 hrs to 1600 hrs on Wednesday 23 November.

LeCroy at RAL
Wednesday November 16, 1983

LeCroy Research Systems will be showing their range of high speed instrumentation for HEP, FUSION and NUCLEAR physics research between 10 am and 4 pm in R20 Conference Room.

Two illustrated talks will be given in the MAIN LECTURE THEATRE between 11.30 and 12.30 and 1.30 to 2.30 on FASTBUS and FAST TRIGGER PROCESSING with ECLine.

The demonstration will include the new high density, programmable HV supply and CAmac Booster processor 'CAB'.

Library Notice

Would the person who has borrowed the journal entitled 'Chemical Physics Letters', Vol. 99 No. 1 1983 please return it to the Library, forthwith.

Would staff please check their offices for this book:

"Introduction to Interactive Computer Graphics" by J E Scott.

It is required by other borrowers.

Table Tennis

Owing to injuries and departures, the Table Tennis Club requires additional players to play in its teams in the Didcot League. Sixth Division players are wanted most urgently, but all standards are welcome.

For more information please contact Tim Pett, Ext: 5332.

Obituary

Don Blackford

It is with very deep regret that we announce the sudden death of Don Blackford on Sunday, 23 October.

Don had worked with Engineering and Building Works Division for over twenty years. During that period he established himself as an expert in electrical installation work in many S E R C establishments - RAL, ROE, RGO, Swindon Office, Oxford Street, 5-11 Holborn, Garrick House, Appleton Lab, Atlas Lab etc. He made an enormous personal contribution to the projects involved, working with a sense of deep commitment and dedication towards a good finished job.

He was greatly respected by his colleagues and contractors alike. In all respects he was a real person doing a real job of work in a very honest and straightforward way.

Don will be very sadly missed by us all. We extend our sympathy to his widow, Lily and his son, John in their bereavement.

Lifeboat Collection

The 1983 Lifeboat appeal at RAL raised £104.25. Thank you to all who contributed and a special thank you to the messengers who did the collecting.

Missing

The following inventory item has been removed from G7 Lab R2:
Tektronix plug-in amplifier type 7A19
Ser.No. B031844 RAL No. X000383.
Please return to Chris Bonfield or contact him on Ext: 5219/5569.

Thanks

Harry Webb writes "I send my warmest thanks to all those who contributed to my Retirement presents - one of which is firing on all 4 Channels! Also for the flowers given to my wife. It was certainly a memorable day for me.

I should also like to take the opportunity of saying Cheerio and thanks to all those I was not able to see on Friday.

Again my thanks to you all, and my best wishes for the future."

Harry Downs Tools

No one was in the least surprised at the large number of people who attended Harry Webb's farewell ceremony on Friday 21 October. In 23 years one can make many friends and Harry certainly did that.

Equipped with one of Ray Roberts traditional retirement cards, featuring Harry's life history in cartoon form, Gordon Walker (Head of Instrumentation Division) outlined Harry's long career in public service.

He had begun his association with this area when, as a regular serving member of the RAF, he flew from Harwell Aerodrome to France for active service in 1939. In 1946 he left the RAF and became a craftsman for the No. 32 Base workshop REME at Didcot from where he joined AERE in 1953 as a mechanic to work on Zeta. In 1960 he joined NIRNS as a craftsman working on Nimrod, hydrogen targets, bubble chambers, cryostats and high energy physics apparatus. In the course of these duties he became R9/R12 workshop chargehand, and an expert, it is said, on the better hostelries of Geneva.

Presenting Harry with a colour TV set and a plaque bearing the SERC logo,

Harry, Gordon and logo. (85RB5017)

Gordon thanked him for his service to the Lab and to Instrumentation Division. The attendance of so many people showed in itself, the high esteem in which Harry was held by his colleagues.

Harry, in reply, thanked Gordon for his kind words and all his friends and colleagues for the gifts and card. "I wish you all the best for the future - thanks very much again," he said.

Christian Fellowship

Meeting of the RAL Christian Fellowship will take place in the R2 conference room at 12.30 pm on Thursday. All are very welcome.

DATES FOR YOUR DIARY

17 Nov Bible study - Martin Steel
1 Dec Fellowship - Margaret Summers
8 Dec Prayer Meeting - Frank Smith

Crib

The RAL Lunchtime Crib League 1983/84 season is under way. We play 11 matches from October to December and 11 from February to April.

We have two new teams - HURON (R2 mechanical workshop SNS) and LIVE WIRES (R66 Instrumentation Division).

After 3 matches, last season's front runners are at it again. JOKERS have 3 wins and 6 points and KLONES have 2 wins and 6 points.

Anyone interested in playing should contact Tony Lubbock, R2 or any other player.

Art & Craft Exhibition

15, 16 & 17 November
R68 Conference Room
12 noon to 2pm
and
Wed 16 November
5.15pm to 8pm

Radio-Control Models

Flying Display

I am hoping the weather will be kind to us on the 14 and 15 November when we shall be having a flying display from 12.30 - 13.30 pm on the sportsfield. Additionally there will be a few models on display at the Art and Craft Exhibition in R68.

This is a newly formed club for anyone interested in radio-controlled models as a hobby. At present we have only aircraft, but would be interested in any enthusiast's radio-controlled cars and boats.

So, we hope to see you at our flying display, or if you would like to join the club, please give me a ring.
P C Angell, Ext: 5545/5505.

Netball Club

All enquiries concerning netball at RAL should now be addressed to Mrs H Dorsett, Ext: 5400.

Bulletin

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Deadline for insertions: