RUTHERFORD Bulletin 14

11 July - 1 August 1977

HEP: Midsummer Report

News from Leningrad, Budapest, CERN & RL

What with all the excitement generated by news of the SNS approval and the official opening of the Central Laser Facility, the High Energy Physics front has been somewhat neglected in recent Bulletins. We are rectifying the situation with this issue as there are four items directly or indirectly associated with this important branch of science. In order of length, we have an article from Peter M Watkins and John Litt at CERN on the first published results from the SPS; a report on Gordon Walker's visit to the Leningrad Nuclear Physics Institute last May; a "Charming" story from Ken Paler and a short comment from Professor Gabriel Karl, a visitor to the Lab's Theory Division on exciting news from the Budapest Conference on Particle Physics, held at the beginning of July. A fair selection of the transparencies presented at the Budapest Conference are available in the Library, and for those visiting CERN in the near future, news that L Lederman will be lecturing on UPSILON (9.5), the 'exciting news' mentioned above, at CERN on 20 July. D Litke from SLAC, who also presented an interesting paper at Budapest, will be visiting RL shortly and will give a talk on 'Recent Results from SPEAR'. This lecture is provisionally fixed for Thursday, 21 July at 2 pm in the Lecture Theatre so watch TODAY noticeboards for confirmation.

Reporting from CERN

The construction of the Super Proton Synchrotron (SPS) at CERN was approved in 1971. In November 1976 the first high-energy particle beams were delivered to the waiting experimenters; the machine is now operating on a regular basis, accelerating protons up to 400 GeV and sending differenct types of particle beams into several sets of experimental equipment.

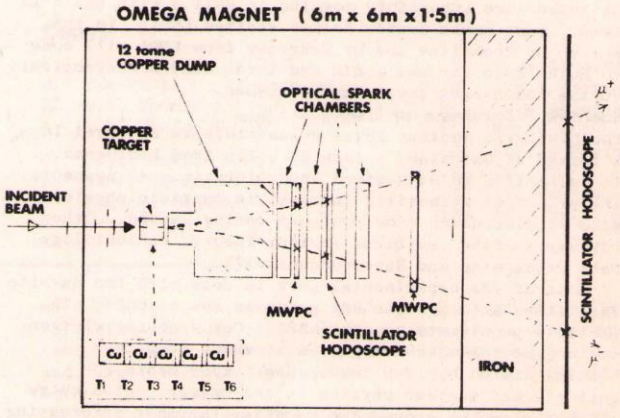
So far, about forty different experiments have been approved involving scientists from about sixty universities and research centres in Europe, the USA and the USSR.

The first published results (M J Corden et al Physics Letters 68B (1977)) have come from a collaboration of 29 physicists from Birmingham University, CERN, the Max Planck Institute in Munich, the University of Neuchatel, Ecole Polytechnique in Paris and the Rutherford Laboratory. Dr J D Dowell (Birmingham University) is the Spokesman for this international team. Using the Omega magnetic spectrometer, the group has successfully measured the relative cross-sections for producing "psi" (ψ) particles from copper using incident 40 GeV/c beams containing pions, kaons, protons and anti-protons.

The ψ particle was discovered in the USA in 1974 in experiments using the proton accelerator at the Brookhaven National Laboratory and the e^+e^- colliding beam machine, SPEAR, at Stanford. The discovery was so significant and exciting that Professors Samuel Ting and Burton Richter were jointy awarded last year's Nobel prize for physics. Subsequently, an intensive study of the properties of this new particle and a search for other particles has produced great activity amongst particle physicists.

'Beam Dump' Experiment

In these new results from the CERN SPS, the ψ particles were detected as they decayed into two muons (μ^+ and μ^-). An intense beam of about 3 million hadrons per second (ie a mixture of pions, kaons, and protons or antiprotons) was directed onto a 200 mm thick copper target followed by a 1.5 metre-thick copper "dump" placed inside the Omega magnet as illustrated in the sketch.



SKETCH SHOWS LAYOUT OF APPARATUS USED FOR DETECTING TWO MUONS FROM THE DECAY OF THE ψ PARTICLE. TARGET DETAILS (INSET), SHOWING INTERLEAVING OF 4 CM THICK COPPER SLABS WITH SCINTILLATION COUNTERS, T1-T6.

The copper dump acts as a filter to absorb most of the hadronic particles produced. The high-energy muons can easily penetrate this amount of material and were detected using scintillation counters, multiwire proportional chambers and optical spark chambers. An extra 1.25 metre thickness of iron acted as a second filter for hadrons. The emerging muons were detected with a 6m by 4m hodoscope constructed by the Rutherford Laboratory.

During the 20 day run, over 5×10^{10} beam particles were sent into the dump, producing about 1000 muon pairs from the decay of the ψ particles. The incident beam particles were individually identified using

cont. on p.2.

Cerenkov counters, and hence the rates for producing ψ particles were compared using negative beams of π^-, K^- and $\bar{p}$ and positive beams of π^+, K^+ and p

The results summarized in table below, show that the ψ particle is produced equally well by pions, negative kaons and antiprotons, but is much harder to produce by protons.

$\sigma(\pi^-) : \sigma(K^-) : \sigma(\bar{p}) = 1 : 1.0 \pm 0.3 : 1.0 \pm 0.3$		
$\sigma(\pi^+)/\sigma(\pi^-)$	$\sigma(K^+)/\sigma(K^-)$	$\sigma(p)/\sigma(\bar{p})$
0.87 ± 0.14	0.85 ± 0.50	0.15 ± 0.08

Ratio of ψ production cross sections for $\pi^\pm$, $K^\pm$, p and $\bar{p}$ incident particles on copper.

The production of the ψ is believed to result from the collision of a quark from one particle with an antiquark from the other. There is now strong evidence that all elementary particles are composed of quarks (of several kinds) and this type of experiment can shed light on the details of the quark content in different types of particles.

The new result showed that the antiproton produces about six times more ψ particles than the proton. This is in agreement with the prediction from certain quark models, but differs from the expectations of other models. The Beam Dump Group has just been approved further running time at the CERN SPS to continue to study the ψ in finer detail.

The discovery of the ψ particle has led to the introduction of a new quantum number called "charm". There are several experiments currently running at the SPS to study charm states produced by high-energy beams of hadrons, photons and neutrinos. We look forward to preliminary and exciting results to be presented at the summer conferences this year.

A Visit to LNPI

Exchanges of information and visits between the Rutherford Laboratory and the Leningrad Nuclear Physics Institute (LNPI), at the Academy of Sciences of USSR continue.

Dr Gordon Walker, Physics Apparatus Group, has recently returned from a two week visit to LNPI and he has kindly supplied some interesting comments on the Institute's work and some light-hearted advice for future travellers.

LNPI – RL Collaboration

Following Dr J J Thresher's visit to LNPI in 1974 an agreement was established between Rutherford Laboratory and Leningrad Nuclear Physics Institute for collaboration on the measurement of spin rotation parameters in π p scattering.

As part of the agreement Dr Tim Broome from HEP Division worked at LNPI last year for a period of three months with one of the experimental teams using the LNPI synchro-cyclotron. Tim's main activity was to write a Monte Carlo simulation for the Leningrad experiment on the spin rotation parameters in π p elastic scattering. This was coded on the Institute's BESM 6 computer in fortran.

Later in the year Dr Sergei Kruglov spent one month at Rutherford Laboratory working in Hall 3 with the π 12 team. Last month Gordon Walker visited LNPI. In the autumn Dr Prokofiev and Dr Bekrenev from LNPI will come to Rutherford for one month and three months respectively. Further exchanges are being discussed.

Scientific Programme at LNPI

The Leningrad Nuclear Physics Institute is situated in a forest at Gatchina, a town 25 miles from Leningrad. It is similar to Rutherford Laboratory in many respects. The principal scientific interest is particle physics with studies using slow neutrons coming second. Other Divisions of the Institute include Theory, Radiobiology, Data Processing and Superconductivity.

Most of the experimental work is done with the on-site facilities although one HEP group is now at CERN. The particle physicists use the LNPI 1 GeV synchrocyclotron, the magnet for which weighs in at about 8000 tons beating Nimrod by 1000 tons. Many experiments on particle and nuclear physics in the energy region below 1 GeV are set up around the machine, the most interesting (to a biassed RL observer) being those on π p scattering.

The neutron beam users are served at present by a 16 MW research reactor which produces a peak neutron intensity of 4×10^{14} per cm^2 per second. Construction of a 100 MW reactor has started. The number of staff totals about 1000 but there are some unfilled craft posts due "to the much higher salaries in industry"!

The site canteen puts the RL restaurant into a Michelin 5 star class.

Instrumentation

In general the instrumentation in particle physics is following trends now well established in the West. Camac has now become widely used in high energy physics experiments throughout the Soviet Union and is expected to be adopted in other fields, thereby becoming a genuine world standard.

A network of computers in the Daresbury fashion services experiments throughout the Institute and in the High Energy and Neutron Laboratories in particular. Pride of place in the synchrocyclotron experimental area went to a PDP 11. Studies with a pair of 1 mm pitch proportional chambers have demonstrated that a resolution of 0.1 mm is achievable.

In the basement of the high energy physics some interesting holographic memory storage was being studied. It is planned to store all the Patents Office information in the field of nuclear reactors and nuclear physics in hologram form. One hundred discs will be required. The access time will be of the order of a few seconds.

Pitfalls for the Traveller

Making his second visit to the Soviet Union, Gordon Walker went prepared with a universal sink plug, a rudimentary plumbing knowledge for repairing continuously flushing cisterns, packets of biscuits to compensate for missed or late meals and like the GI's in wartime Britain armed with dollars, chewing gum and nylons.

Visas are often delivered to almost the steps of the aircraft but Gordon's visa missed the planned flight by four days. The actual arrival at Leningrad four days after the final receipt of the visa occurred quite unknown to the LNPI hosts due to a combination of slow telex delivery at Leningrad and May Day celebrations. Fortunately, a hotel room was found in town with the help of the GI survival kit. The only really difficult problem arose in trying to find the telephone number of LNPI, the one on the headed notepaper being out of date. Telephone books and directory enquiries seem to be non-existent. By chance, a personal friend of the Institute's director came into the hotel after the receptionist had spent thirty minutes trying to find the number, and he had the number in his personal diary.

The visit was most interesting and made most enjoyable by the excellent hospitality provided. The Academy of Sciences were most insistent that theatre tickets and escorts (male!) were provided almost every evening for a 'full cultural programme'. Does the SRC have a corresponding facility?

Heaviest Resonance Discovered

At the recent European Physical Society Meeting in Budapest evidence for a heavy resonance was presented by a Group lead by L Lederman working at FNAL.

The new resonance was seen in the reaction p + Nucleus $\rightarrow \mu^+ \mu^-$ + anything. It's mass is 9500 MeV, it was named UPSILON (9.5). In analogy with the J/Ψ it is believed that the UPSILON heralds a new type of Quark.

RL Has Charm

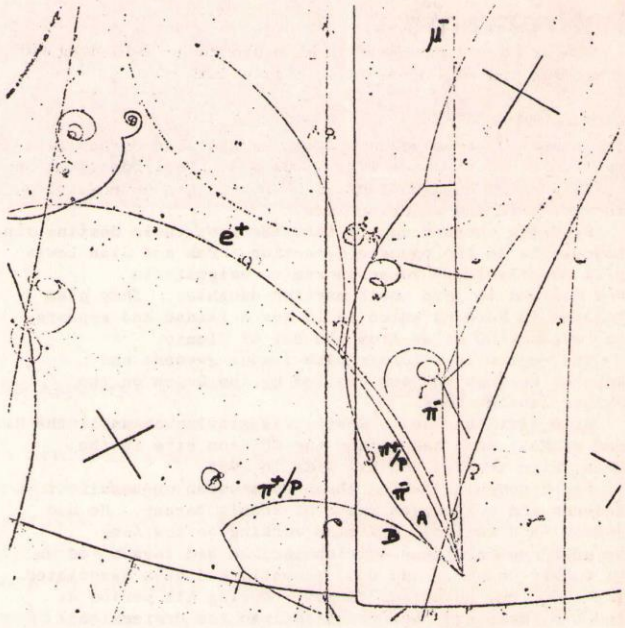
Members of the Rutherford Bubble Chamber Group, in collaboration with teams from Bari, Birmingham, Brussels, Ecole Polytechnique, Saclay and UCL, are presently involved in a search for charmed particles produced in neutrino interactions.

Two bubble chamber experiments at FNAL have given widely differing results for the process, and so when it was decided to run a test of the wide band neutrino beam at the SPS in April, the collaboration (whose main aim is to study neutrino interactions using the track sensitive target in BEBC) took the opportunity to try to resolve the discrepancies.

Over 30,000 pictures were taken during the run, using BEBC filled with a Neon/Hydrogen mixture; most of these have already been scanned, and measurement has started. A number of candidates for charm production have been observed - the signal is the presence, in an otherwise ordinary charged current neutrino event, of a positron.

In the pictured event (which was found at Rutherford the positron is clearly visible while tracks A and B make a possible neutral strange particle (K^o or Λ) which decays very close to the primary interaction vertec this being a strong signature of the decay of Charmed particles.

It is intended to report the results of this experiment at the Hamburg Conference in August.



REC. SOC. NEWS

A copy of the current Society Rules is now on display in R15. Further copies can be obtained from the Chairman, R E Thomas (R27, Ext 6219).

Table Tennis League

The new season of the Didcot and District Table Tennis League will soon be upon us. Anyone interested in playing for an evening team should contact Eric Thomas (Ext 6219) before the end of July.

A meeting will be held in the Conference Room, R27, on Monday 15 August at 12.30 to decide on the teams. All interested are urged to attend, but, if you cannot, please let Eric Thomas know your views beforehand.

Table Tennis Ladder Tournament 1976/77

A Tournament was held on 18 May in R15 Recreational Hut to decide the winner of the Ladder Competition for this season. 16 players from the top positions took part. After the pool rounds, 8 proceeded to the knock out stage. The first knock out round produced some close matches; in particular, Harry Jarvis found himself with match point against Eric Thomas. However, the shock proved too great, and Harry was not able to keep up the pressure.

In the semi-finals, Peter Kent beat Eric Thomas in a fast match, and Tim Pett wore down John Varley. Eric gained some consolation by beating John for 3rd place.

In the final, Peter started well, winning the first game. However, as has so often happened in the past, Tim kept on plugging away, and took the second. Peter's attack had began to lose its consistency, and he was forced to play for safety, but Tim always had the edge. However, at 15-12 to Tim, a "time-out" was called, as this game had been going on for 15 minutes.

This introduced a change in play known as "Expedite", where each player serves alternately, and the server must attempt to win the point, rather than defend. If the receiver gets the ball back 13 times, he is considered to have won the point by default! Peter proved to be better at this than Tim, and eventually won 21-18 to become our first Rutherford Ladder Champion.

Congratulations to Peter Kent the new Champion for 1976/77 Ladder Tournament, and many thanks to John Varley who organised the Tournament so successfully.

Results

1	Peter Kent	WINNER	9	Dick Roberts
2	Tim Pett	runner-up	10	Any McPherson
3	Eric Thomas)	semi-finalists	11	Dave Browett
4	John Varley)		12	Robin Aitken
5	Peter Horton)		13	Gordon Scott
6	Harry Jarvis)	¼ finalists	14	Jean Kent
7	Kenichi Konoshi)		15	Ken Robinson
8	Peter Tipper)		16	John Whittaker

OVERSEAS VISITS

Mr A V Chilvers, to CERN 11-14 July; modifications to existing electronic equipment.
Dr J J Thresher, to the USA, 14-27 July, to attend SLAC conference and hold discussions at FNAL and LBL.
Mr G H Rees, to the USA, 17-21 July, to visit ANL.
Dr J D Lawson, to Greece, 17-24 July to attend International Summer School and Conference on Plasma Physics.
Dr G C Stirling to ILL, 18-22 July for discussions.
Dr T R M Edwards, to ILL 18-29 July for on-line software work.
Mr A G D Payne, to ILL, 18 July 1 Aug; neutron lifetime experiment.
Mrs E Marsh, to DESY, CERN and ILL, 18-22 July, for discussions on library matters.
Mr M J Hotchkiss, to CERN, 18-29 July, to work on WA3.
Dr C J S Damerell, to CERN, 19-21 July, to attend meetings.
Dr B H Bracher, to CERN, 20-27 July, to work on WA7 software.
Dr K Konishi, to the USA, 22 July-7 Aug, to attend LBL conference.
Dr P T Rumsby, to the USA, 22 July - 14 Aug, and Dr M Key to the USA 25 July - 12 Aug, for discussions with various labs, on laser compression programmes, scientific results and target chamber development. Dr Key will also attend Gordon Conference.
Dr J J Thresher, to CERN, 29 July - 9 Aug, to work on hyperon experiment.

SALES TO EMPLOYEES

Sales of scrap metal/plastics as set out in RLN 12/73 will be made on 5 and 19 August 1977.

EDITORIAL NOTE

Publication of this issue has been unavoidably delayed, and although still carrying its original date, 11 July, for record purposes, it will now cover a period of three weeks, 11 July - 1 August.

The dead-line for the next issue, No 15, will be 1000 hours, Tuesday 26 July.

Retirements

Several retirement reports have had to be held over but these will be published as soon as possible.

Going Down Under

It is nearly three years since Anne and Alan Bishop left the Lab to start a new life in Canada. Their destination was Vancouver BC and from all accounts they have settled in very well and enjoying life.

Recently another couple left the Lab; their destination however is in the opposte direction. Pam and Stan Lewis will shortly leave these shores to emigrate to New Zealand to join their married daughter. They plan to live in Rotorna which is in North Island and appears to be about 60 miles from the Bay of Plenty.

The region is volcanic with famous geysers and sulphur springs and was visited by the Queen on the Silver Jubilee tour.

Stan left the Lab in April, Pam staying on until the end of May; both had joined the Chilton site in the 60's, Stan in 1964 and his wife in 1965.

Mac Snowden in making the presentation on behalf of friends and colleagues spoke of Stan's career. He had joined as a skilled craftsman working on the long defunct Proton Linear Accelerator; he had then moved on to bubble chambers and more recently had been associated with P55, the polarized target. During his period at the Lab, Stan had been promoted into the Professional and Technical Officer class.

Mac commented on the youthful appearance of the retiree, perhaps due to being a fresh air fiend and a keen caravaner. Stan and Pam must, Mac thought, be the youngest grandparents amongst the RL staff. In conclusion Mac wished Stan success in his new life in New Zealand and handed over a splendid carriage clock.

In reply Stan a man of few words, thanked everyone for the gift; adding that he had enjoyed his time at the Lab and he would never forget all his friends and colleagues.

Pam left a month later having worked for the first 8½ years as a part-time scanner. She has been employed full-time since 1974 in the General Admin Office in R1, giving a service which has always been cheerful and helpful, 'in fact', Hugh Roskell, who made the farewell presentation, commented, 'if she has ever refused to help anyone, I am sure the "rotten boss" (Hugh) would be blamed and not Pam'

Pam, naturally, is eager to get to New Zealand to join her married daughter and to see, for the first time, her few months old, grandson. Pam's popularity was amply demonstrated by the number of people jammed into the R61 conference room and by the number of gifts including a most beautiful Waterford cut glass sherry decanter (complete with bottle of sherry), Waterford cut glass whisky glasses, flowers etc.

Everyone who had occasion to meet her and seek her cheerfully given service will join in wishing Pam and husband Stan the very best of luck in their new life, it should be quite a day when they and their 18 year old son (not forgetting dog 'Beckie') arrive 'down under' for the family reunion.

Green Fingers

Our grounds - lawns, roses, flowering trees, shrubs etc, are often the subject of comment from visitors. The person who has been responsible for the grounds, Ernie Eltham, retired at the beginning of June after 20 years service with the grounds department at AERE. Ernie has been charge-hand responsible for the RL site, for the past five years and although probably not known by name to many people here, his standard of excellence in providing such an attractive environment has been much appreciated by staff and visitors alike and we wish him a long and happy retirement.

A 'Fun' Farewell

Retirement presentation occasions are usually a time of mixed feelings both for the person concerned and for colleagues. There are exceptions and Joe's, held at the end of May, developed into one of the most hilarious farewells most people present had experienced.

Joe Swain had decided on premature retirement and when the day arrived for his farewell presentation a large number of people including a number of old colleagues from Harwell, packed into the R61 Conference Room.

David Thomas, before making the presentation, spoke of Joe's career covering 30 years continuous service, which had started when he joined AERE Harwell as a draughtsman in March 1947. Promotion to the engineer clan followed and after 14 years, Joe joined the Rutherford Lab in January 1961. His expertise was very wide and he had done a fantastic job for the Lab. In conclusion David presented him with a pair of high powered binoculars contributed by friends and colleagues.

In replying, Joe's sense of humour soon had everyone roaring with laughter. He had played cricket for many years, now a spectator and the gift would be put to good use. Joe claimed that his wife had issued him with a list of don'ts, to be observed when making his thank you speech.

1. Don't forget to thank all your colleagues - they have suffered you for years.
2. Don't make a stirring speech - this is a friendly gathering don't turn it into a demo.
3. Don't reminisce - about how things were done in the past, they have heard it many times in the past and it is boring.
4. Don't give advice - they never did take any notice, why should it be any different now?
5. Don't tell any of your risky stories - there will be gentlemen present.

Following more humour from Joe, plus plenty of asides from old colleagues, the party came to an end or so most people thought, but no.

Ron Newport stepped forward to make a second presentation on behalf of the old bubble chamber gang - a bottle of duty free liquor in a very old and tattered 'Geneva' carrier bag, recalling memories of yore.

Once again a good deal of banter and the party was over. Once again we were wrong as Peter Hatton came on the scene to say a few words, and tell a few stories, on behalf of the drawing office staff. His signal to the door was followed by the familiar strains of the BBC's introductory music for the Apollo moon shots (Zarathustra by Richard Strauss), which in this case heralded the entrance of drawing office staff carrying a flying saucer in the form of a huge plastic polomint complete with flared skirt. The rim of the 'saucer' carried the signature of the drawing office staff.

Maybe, "Thus spake Zarathustra", but not Joe who for once was utterly speechless, the rest of the company being, by this time, helpless with laughter.

Joe certainly had received the most uproarious farewell anyone could remember.

In a letter Joe has this to say, " I should like to thank everyone for making my retirement day a memorable one. So much was happening that I'm sure that I missed saying thank you to a number of my colleagues.

I hope that the Laboratory has a fruitful and prosperous future. My good wishes to all the staff".

FILM BADGE NOTICE — Period 8 commences Monday 11 July. Colour strip - YELLOW for $\beta\gamma$ films and neutron packs.

Six monthly dosimeter change for people with surnames commencing C, D, E and F.

Please change your dosimeter promptly and return all old ones.

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