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NEWSLETTER

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**TASCC**

News about Chalk River's Tandem Accelerator Superconducting Cyclotron facility for users and potential users

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## Allan Bromley visits TASCC, presents talk

D. Allan Bromley, Sterling Professor of the Sciences, Yale University, visited TASCC Thursday 26th August and presented a general-interest talk "Science and Technology Policy in a Rapidly Changing World".

His one-hour talk gave a broad perspective of U.S. science policy plus some details of the initiatives in which he was involved during his four-year tenure as Science & Technology Advisor to former-president George Bush. In introducing the presentation, TASCC Director John Hardy pointed out that Prof. Bromley is one of the very few practising scientists to have affected science policy at this level.

Born just an hour's drive from the Chalk River Labs, Allan Bromley was a researcher in the Nuclear Physics branch here in the late fifties and sixties, doing pioneering work in nuclear physics.

## TRC written report released

The final report of the 1993 Nuclear Physics Technical Review Committee (TRC) was received this month by TASCC management. The report, based on the annual visit to Chalk River by an independent group of six Canadian and international reviewers, is almost totally positive.

In his covering letter to TASCC Director John Hardy, TRC chairman Prof. Jean Barrette of McGill University reported that "Clearly the Committee . . . was most impressed with the flurry of activities that went on last year."

The committee's report, which comments on each of the experimental and theoretical programs in turn, notes the increased visibility of TASCC results at major conferences and also the increased use of cyclotron beams. "The cyclotron is now an important

(continued)

## George Hodgson 1934-1993

George Hodgson, the senior operations' shift supervisor at TASCC, died suddenly Friday, August 20th. He collapsed on arrival at the accelerator facility for the start of his regular shift and was rushed by AECL ambulance to the Deep River hospital where he died shortly afterwards. Saddened staff, family and friends attended funeral and burial services Monday 23rd in his home-town of Petawawa.

George joined TASCC in 1976 after serving as an operator in the NRU research reactor for 16 years. He will long be remembered by staff and particularly his fellow operations crews for his attention to detail, his constant quest for perfection and his warm, mischievous humour.

All TASCC staff and colleagues join in expressing sorrow and offering condolences to George's wife Brenda and his family.



## 8 new intruder bands discovered

In a recent experiment with the  $8\pi$  spectrometer, eight new "intruder bands" were found in iodine-115, tellurium-114 and neighboring nuclei. The experiment was led by Eddie Paul, a TASCSC summer visitor from the University of Liverpool.

The new intruder bands in this mass region typically are comprised of 8 to 14 quadrupole gamma-ray transitions and can reach as high as 28 MeV in excitation energy and  $89/2\hbar$  in angular momentum. They reveal some unusual properties, including very high rotational frequencies (the highest observed in heavy nuclei) and surprisingly low dynamical moments of inertia.

Theoretical calculations by another summer visitor, Ingemar Ragnarsson from the University of Lund, indicate that these properties are due to the occupation of orbitals accessible only at high spin and in neutron-deficient nuclei near the  $Z=50$  "magic" shell closure. His calculations also predict that many of these collective bands exhaust virtually all of the available nuclear spin at low-to-intermediate rotational frequencies.

It is suggested that at the highest frequencies observed in experiments, the prolate collective states lose their collectivity and the bands eventually terminate in oblate non-collective states. This form of band termination is unusual because of its smooth progression, and also because precisely the same orbitals are involved in both the collective and non-collective phase.

Intruder structures in the light tin and antimony nuclei have been extensively studied with the  $8\pi$  spectrometer over the last two years.

The observation of many more such bands in iodine and tellurium nuclei, which are slightly farther away from the tin shell closure, is expected to help us understand the mechanism behind these interesting structures.

### TRC report continued

and integral part of the research activities at TASCSC" it concludes.

The applied programs at TASCSC were also examined by the TRC. While praising the efforts of those involved, the TRC remarked on one "paradox":

## Facility report

Tandem availability has been running at an all-time high of over 78 percent recently, which includes operation above 14.2 megavolts on its terminal. In addition, the cyclotron has been running extremely stably, with periods of beam production which required no control adjustments for periods up to 12 hours.

The current version of the cyclotron deflector, with a water-cooled stainless-steel electrode, has now been in continuous operation, untouched, for more than four months. It has operated for a variety of beams, at up to 77 kilovolts over its 5 millimetre gap.

Persistent summer thunderstorms in the area caused five power outages during a single night, resulting in a total of 20 hours lost beam time, not to mention frustration among researchers and operations crews alike. As well, another brief outage 36 hours later delayed a beam-line setup two hours.

Beams produced for experiments during August were:

Ion	Energy (MeV)
$^{12}\text{C}$	19
$^{28}\text{Si}$	60 & 75*
$^{35,36,37}\text{Cl}$	100
$^{37}\text{Cl}$	138
$^{58}\text{Ni}$	250
$^{127}\text{I}$	136
$^{209}\text{Bi}$	84*
$^{208}\text{Pb}$	69*
$^{238}\text{U}$	68*

\* Injection energy (beam not extracted)

that a country with "a large nuclear industry, with excellent fuel element metallurgists and a remarkable instrument to simulate fission fragments" (TASCSC) had very little coordinated effort to combine these pieces.

Members of the 1993 committee are: Prof. Jean Barrette, Prof. John Sharpey-Shafer (University of Liverpool), Dr. Yves Quéré (Ecole Polytechnique, Plaiseau, France), Prof. Ed Tomusiak (University of Saskatchewan), Dr. Dave Clark (LBL, California) and Dr. Ernst Roeckl, (GSI, Darmstadt).

## August experiments

<b>Experiment</b>	Study of resonant-coherent excitation (RCE) of hydrogen-like silicon ions in a silicon crystal with axial channeling. Both $N=1 \rightarrow 2$ and $N=1 \rightarrow 3$ resonances were observed.
<b>Researchers</b>	J.U. Andersen ( <i>Aarhus U.</i> ); J.A. Davies ( <i>McMaster U.</i> ); H. Geissel and F. Nickel ( <i>GSI-Darmstadt</i> ); J.S. Forster, G.C. Ball, W.G. Davies and J.S. Geiger ( <i>TASCC</i> )
<b>Beam</b>	27 MeV/u $^{28}\text{Si}$
<b>Duration</b>	5 days
<b>Experiment</b>	Search for intruder bands in $Z=52,53$ nuclei. On-line analysis provided evidence for eight such bands in iodine-115, tellurium-114 and neighboring nuclei..
<b>Researchers</b>	E.S. Paul ( <i>Liverpool U.</i> ); V.P. Janzen, H.R. Andrews, D.C. Radford and D. Ward ( <i>TASCC</i> ); S. Pilotte ( <i>U. of Ottawa</i> ); T.E. Drake and J. DeGraaf ( <i>U. of Toronto</i> )
<b>Beam</b>	250 MeV $^{58}\text{Ni}$
<b>Duration</b>	6 days
<b>Experiment</b>	Measurement of level lifetimes in indium-109 and nearby nuclei by DSAM. Some of the low-energy transitions showed large shifts, suggesting an association with states of higher deformation than expected.
<b>Researchers</b>	T.E. Drake and J. DeGraaf ( <i>U. of Toronto</i> ); V.P. Janzen and H.R. Andrews ( <i>TASCC</i> ); E.S. Paul ( <i>Liverpool U.</i> ); S. Mullins and S. Flibotte ( <i>McMaster U.</i> ); S. Pilotte ( <i>U. of Ottawa</i> )
<b>Beams</b>	138 MeV $^{37}\text{Cl}$
<b>Duration</b>	4 days
<b>Experiment</b>	AMS measurement of chlorine-36 content of 40 samples and standards, many of which were part of an on-going effort to improve processing procedures for rock samples.
<b>Researchers</b>	H.R. Andrews, J.C.D. Milton, B.F. Greiner, Y. Imahori and J.W. McKay ( <i>TASCC</i> ); R.R.J. Cornett and G.M. Milton ( <i>Environmental Research Branch, CRL</i> )
<b>Beam</b>	100 MeV $^{35-37}\text{Cl}$
<b>Duration</b>	3 days
<b>Experiment</b>	Measurement of forward elastic recoils in various samples. A counter telescope consisting of a gas $\Delta E$ counter and a solid-state E counter was used for the first time and worked very well, allowing clean identification of elemental species as heavy as arsenic. Further work will continued on the McMaster University FN Tandem.
<b>Researchers</b>	J.S. Forster ( <i>TASCC</i> ); J.A. Davies and R. Siegele ( <i>McMaster U.</i> )
<b>Beam</b>	19 MeV $^{12}\text{C}$ ; 60 MeV $^{28}\text{Si}$ ; 136 MeV $^{127}\text{I}$
<b>Duration</b>	5 days
<b>Experiment</b>	Development of beams of bismuth, uranium and lead in the superconducting cyclotron. Beams were injected and accelerated in the $>5$ Tesla field, but not extracted at this time.
<b>Researchers</b>	TASCC Beam Commissioning Team
<b>Beam</b>	6.7 MeV/u $^{209}\text{Bi}$ ; 5.25 MeV/u $^{238}\text{U}$ ; 5.6 MeV/u $^{208}\text{Pb}$
<b>Duration</b>	6 days

Opportunity is missed by most people because it is dressed in overalls and looks like work.

THOMAS EDISON

The more I want to get something done, the less I call it work.

RICHARD BACH

## Next month . . . . .

- Search for superdeformation in gadolinium-151
- Time evolution studies
- Gas-jet studies for Sudbury Neutrino Observatory
- Spectroscopy of mass-50 nuclei
- Study of neutron-deficient europium and gadolinium

## Facility operating record

Elapsed Time (Year-to-date)	5783 h
Beam Available	
Tandem Only	3239.6
Tandem + Cyclotron	803.8
Beam Development	778.6
Planned Shutdown	591
Forced Shutdown	370

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