Heavy ion accelerators proposed at Brookhaven and Dubna

The ability to accelerate heavy ions (essentially atomic nuclei) to relatively high energies and strike them against targets has been with physicists for only a few years, but it has already brought exciting new possibilities to nuclear physics (SN: 7/3/83, p. 20; 8/4/82, p. 106). Therefore, more ion accelerating equipment with higher energies is requested. One way to get it is to convert old proton accelerators, whose energy range has been left behind by the particle physics for which they were designed, but which represent an energy gain for heavy ions.

Two such proposals were made public at the recent 12th International Conference on High Energy Accelerators held at the Fermi National Accelerator Laboratory in Batavia, Ill. One involves the Alternating Gradient Synchrotron (AGS) at the Brookhaven National Laboratory in Upton, N.Y.; the other involves the Synchrophasotron at the Joint Institute for Nuclear Research in Dubna, Russia.

When the AGS was completed about 20 years ago, it was the most powerful proton accelerator in the world. Nowadays its top energy of 30 billion electron volts (30 GeV) is surpassed by four other instruments, and the most powerful of those, Fermilab's Tevatron, is now approaching a trillion volts (1,000 GeV). Mark Barton of Brookhaven outlined a proposal to turn the AGS into a dedicated heavy ion accelerator (that is, give up accelerating free protons completely). In connection with storage rings still to be built, it could supply ion beams at energies up to 30 GeV per neutron or proton and collide them with each other. (This would be truly and accurately an "atom smasher.") The most energetic ion accelerator operating now, the Bevalac at the Lawrence Berkeley Laboratory (LBL) in Berkeley, Calif., gets ions to about one billion electron volts per neutron or proton (SN: 10/9/82, p. 228).

The storage rings could be built in the tunnel constructed for the now all but defunct Colliding Beam Accelerator (CBA). The CBA would have been a pair of rings to accelerate protons to 400 GeV and collide them, but its construction has lagged far behind schedule, and the Department of Energy's High Energy Physics Advisory Panel has advised that it be canceled (SN: 7/23/83, p. 52). Physics has passed it by, the panel says. The ion storage rings could also use the magnets made for the CBA, Barton says. It would need only a third as many as the CBA would have, so the cost would be much lower.

Plans are still somewhat fluid, however. Barton points out that theorists are already asking for more. T.D. Lee, says Barton, thinks that 60 GeV per beam would be better. Plans are fluid in another sense, too. According to comments heard in the corridors, this proposal does not yet have overwhelming support from the Brookhaven staff, and other proposals for what to do with the CBA tunnel may surface before a final decision is made.

The Synchrophasotron was Dubna's original large proton accelerator. The plan for a heavy ion accelerating complex as presented by I. Ivanov of Dubna envisions linking the reconstructed Synchrophasotron with two other accelerators built for heavy ions, the Injector Collective Heavy Ion Accelerator-20 (KUTI-20) and the Heavy Ion Synchrotron (TIS). The three together would bring ions to 4.1 GeV per neutron or proton.

The Dubna procedure is similar to what was done at LBL to make the Bevalac. There the Bevatron, one of the first proton accelerators to reach one billion electron volts, was reconstructed and joined to an existing ion accelerator, the Super Heavy Ion Linear Accelerator. The LBL people also have plans for heavy ion storage rings and colliding beams. This project, called Venus, would surpass both the Brookhaven and Dubna proposals in maximum energy. For the moment it seems to be on a back burner. *—D.E. Thomsen*

Mind-altering sweetener? Bittersweet victory for sugar substitute

It has been almost 80 years since the coca was removed from Coca-Cola and the beverage became a "soft" drink with little kick other than a small dose of caffeine. And today even the tiny dose of caffeine is gone from many sodas, as the industry caters to an enormous appetite for beverages that are truly soft. But some soft drinks of the near future may not be soft at all. Last week, with government approval, the Coca-Cola Company and two other soft drink manufacturers announced that they will be adding a new ingredient to their diet soda — an artificial sweetener that, according to one scientist, has the potential for altering brain chemistry enough to affect mood and behavior.

NutraSweet, the brand name for a chemical sweetener called aspartame, was approved by the government two years ago for use in dry foods and as a tabletop sugar substitute (SN: 7/25/81, p. 54), and last month it was approved as a soft drink additive. But according to Richard R. Wurtman, an endocrinologist at the Massachusetts Institute of Technology in Cambridge, aspartame-laced sodas can interact with carbohydrates to cause a significant rise in certain brain chemicals that are known to be involved in regulation of mood and behavior. In a letter in the Aug. 18 NEW ENGLAND JOURNAL OF MEDICINE, Wurtman reports an experiment in which he gave rats aspartame alone and in combination with dietary carbohydrates. The sweetener alone (a compound of two amino acids, aspartic acid and phenylalanine) doubled brain levels of phenylalanine; that effect was again doubled if the aspartame was combined with carbohydrates.

The combination also tripled brain tyrosine, and blocked the normal rise in other chemical messengers. Phenylalanine is normally converted to tyrosine, which is a precursor for a group of neurotransmitters, called catecholamines, which play a part in appetite, sleep and mood, Wurtman told SCIENCE NEWS. In general, the people most likely to experience behavioral changes after consuming aspartame are those with conditions, such as insomnia or Parkinson's disease, that involve abnormal brain chemistry.

In addition, he says, phenylalanine is toxic to neurons at certain levels; in the disorder phenylketonuria (or PKU), brain damage can be caused by high levels of phenylalanine, and indeed people carrying a gene for PKU have been shown to be twice as sensitive to aspartame. The minimum level at which phenylalanine is toxic is unknown, Wurtman says.

The amounts of aspartame used in the rat studies, Wurtman notes, are comparable to what an eight-year-old child might consume on a hot afternoon—if it is added to sodas in the same quantities now used in Canada. (Aspartame has been legal there and elsewhere for some time.) Coca-Cola Company has decided, however, to use both aspartame and saccharin to sweeten its Diet Coke (as will Royal Crown in its Diet-Rite Cola), so that the amounts of aspartame will be less. At lower doses, Wurtman emphasizes, ingesting aspartame is probably without risk (he supported the government approval of dry NutraSweet, in fact, and uses it himself). He says he was encouraged by the soft drink companies' decision to voluntarily limit their use of the additive, and as a result decided not to formally oppose the government's decision. But at least one soft drink manufacturer, Squirt and Company, will be sweetening its beverage (called Squirt) exclusively with aspartame, and other companies could decide to do so in the future.

According to Sanford Miller, director of the Food and Drug Administration's Bureau of Foods, Wurtman's conclusions are inconsistent with the vast literature attesting to the safety of aspartame. Wurtman's results are skewed, he argues, because he used fasted rats; under normal circumstances, when there is protein in the diet, the mobilization of brain chemicals will not take place. *—W Herbert*