Russian physicists came to the feast.

chusetts Institute of Technology, the new high-energy domain is so strange that physicists are still trying to devise a language to use in speaking of the phenomena found there. In his view the points where data disagree with the models are most interesting because this kind of antithesis can lead to the synthesis of better theory.

As experimental devices, the two large machines have already shown scientific justification for their construction, and the results have heartened those working on similar projects. CERN is building a 300-GeV accelerator, which is expected to come into operation in 1976. The project is crowded into a suburb of Geneva and will be built 60 meters underground to allow other uses of the surface. "It's like digging a mine," says G. Giacomelli of the University of Bologna. In contrast he says of the NAL site, "you have so much room here." Land acquisition at CERN is a slow procedure. It is much more difficult to expropriate landowners in France and Switzerland than it is in the United States. So far the laboratory owns only the locations of the six shafts that are being dug down from the surface, but public authorities promise to obtain the rest. There is also a border-crossing problem. The ring will straddle the French-Swiss border. Placing customs posts in a particle accelerator tunnel would be a diplomatic first (and a high-order absurdity). Yet, if totally free access is permitted, Giacomelli warns that "in any large group there will be a few guys who will take advantage."

In the United States the meeting results gave increased enthusiasm to proponents of project Isabelle, which would provide storage rings for the Alternating Gradient Synchrotron at Brookhaven National Laboratory. And there is already talk of building a bypass at the National Accelerator Laboratory so that the main beam could collide with its own 8-GeV booster. □

The drama of Cygnus X-3: Fits the model perfectly

The drama of Cygnus X-3 continues.

"Rarely in astronomy is the answer so nice and clear-cut," says Robert Hjellming of the U.S. National Radio Astronomy Observatory at Greenbank, W. Va. He was speaking of the cataclysmic radio outburst in Cygnus X-3 discovered by Philip C. Gregory of Canada and co-workers. The outburst must have begun roughly at 7 a.m. Sept. 2. It continued at unusually high levels for three days (SN: 9/9/72, p. 164). Hjellming and Bruce Balick, also of NRAO, as well as astronomers around the world continued to observe the source as it began dying. It hit the peak level of 22 flux units at one frequency the first day. By Sept. 11 it had returned to the normal level of 0.1 flux units. The total radio energy has been calculated to be 10^{40} ergs, assuming a distance of 10 kiloparsecs.

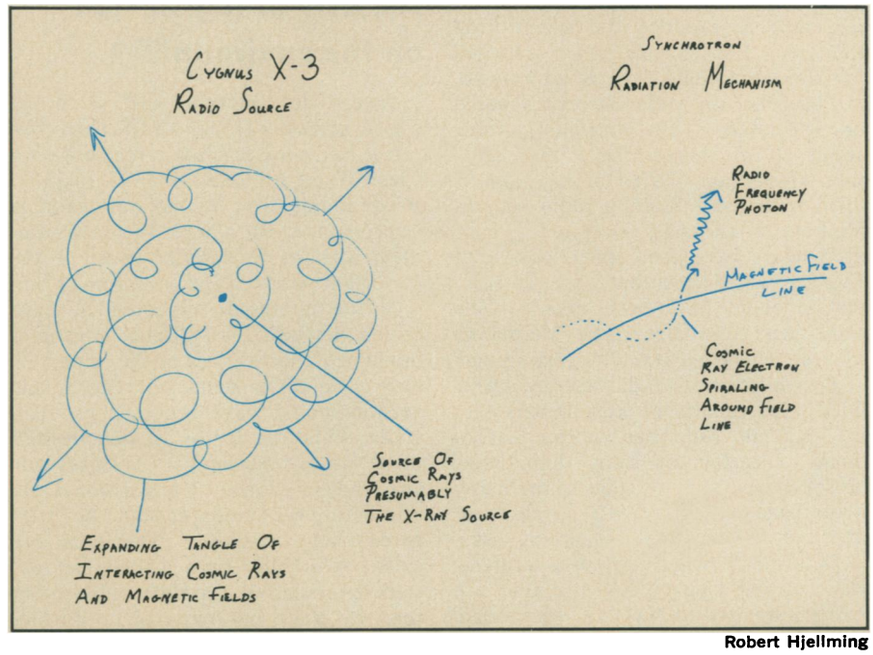
"Anyone looking at the data would come to the same conclusion: It fits perfectly the model for synchrotron or magnetic bremsstrahlung radiation," says Hjellming. Synchrotron radiation is the result of the interaction between electrically charged particles and a magnetic field. It is especially strong at radio wavelengths. Radio emissions from quasars, supernovas and radio galaxies are believed caused by this mechanism.

Kenneth I. Kellermann, also of NRAO, has been studying extragalactic sources of synchrotron radiation (such as quasars and radio galaxies) for several years now. "The Cygnus X-3 phenomenon is very similar to what we see in the quasars," says Kellermann. "But it usually takes months to several years for it to happen. Cygnus X-3 happened in just a few days. Just change the time scale from days to months or years and it fits nicely."

The Cygnus X-3 event makes Kellermann a little happier about his work—and, he admits, a little envious. The theoretical prediction of synchrotron radiation in quasars and radio galaxies has been difficult to confirm precisely. What he sees from quasars and radio galaxies looks similar to what is seen from the Cygnus X-3 event, "but it has never been so nice." Instead of one clear burst and then death, Kellermann sees from his sources a burst, and then another burst before the first one dies. Also, the sources are much farther away, and the energies emitted are much greater. "They have been able to do with Cygnus X-3 in a couple of days what we've been trying to do for years." The fact that Hjellming can interpret the observation so neatly as synchrotron radiation gives support to the theory that synchrotron radiation is the source for radio emissions from quasars and radio galaxies.

There are some puzzles about the Cygnus X-3 event, however. The theoretical model for synchrotron radiation predicts that X-ray synchrotron emissions should also have been present. Cygnus X-3 has been known as an X-ray source, although it has not been determined whether they were synchrotron X-rays. But X-ray observations by the Uhuru satellite show no anomalous behavior during the period of the radio outburst.

Another problem is the source of the cosmic rays. In the emissions of the Crab nebula, it is thought that the



Robert Hjellming

Hjellming's informal schematic of what was probably happening in Cyg X-3.

The road to equality: Education or economics?

All men are not created equal. But it is often suggested that education is the first step on the road to equality. Using economic success as an indicator, the social reformers of the 1960's predicted that a good education could equalize cognitive powers and adult bargaining powers. With such equal opportunities, it was said, everyone would hold the key to success.

A quick trip from the ghetto to suburbia would indicate that the key did not fit. Poverty and inequality remain a part of life because education is not a panacea for these ills, conclude researchers at Harvard University's Center for Educational Policy Research. A team headed by Christopher Jencks has spent four years reviewing and analyzing data from studies on the effects of schooling. Results from the Equality of Educational Opportunity Survey (the survey used to produce the Coleman Report) and Project Talent's longitudinal study of students in 100 high schools were included. The complete report will be presented in *Inequality: A Reassessment of the Effects of Family and Schooling in America* (Basic Books, Oct. 1972).

Reporting on their work in the October SATURDAY REVIEW—EDUCATION, the researchers conclude that eliminating the differences between elementary schools would reduce the range of scores on standardized tests in sixth grade by less than three percent. Even when the schools exert an unusual influence on children, they add, the resulting changes are not likely to persist into adulthood. Thus equalizing educational opportunity will not do much to reduce economic inequality. Similarly, the Harvard group found that I.Q., heredity and family background have little bearing on success in adult life. Brothers with equal results on I.Q. tests, equal amounts of education and equal job opportunities differ in average income by about $5,700. The average income difference between random pairs is only $500 more. These comparisons, the researchers say, suggest that adult success must depend on a lot of things besides family background, schooling and the cognitive skills measured by standardized tests. The researchers have no idea what factors are involved, but they do suggest that special abilities, luck, timing and personality are important in determining economic success.

All of these findings, Jencks and his colleagues believe, imply that school reform is never likely to have any significant effect on the degree of inequality among adults. They suggest that the present educational model be abandoned. The primary basis for judging an educational system should not be how many employable adults it turns out but whether students and teachers find it a satisfying place to be. Schools, the researchers say, should enrich the lives of the children and show a concern for diversity and choice.

The way to attack poverty and inequality, the researchers feel, is not through the education system but through economic institutions. What we need, they say, is what other countries call socialism.

Such attacks on the education system are not rare and attacks on the economic system are almost commonplace. But even if founded in fact, it is doubtful that any amount of research can do anything in the near future to change present trends. The Office of Education announced this week that a record $90.5 billion will be spent this year to provide classrooms and instruction for 60.4 million students. Public schools will employ 20,000 more teachers than they did last year. Aside from representing such a mammoth vested interest, education has become what Ivan Illich calls a secular religion. As such it is almost inviolable.

In addition, liberals will not listen to criticism of anything that they have built their reputations on (equal opportunity, busing, head-start programs, etc.) and conservatives are surely not going to listen to anyone who even mentions socialism. Jencks and his colleagues realize this and admit that legislation along the lines they suggest could not pass Congress. But they add, "That does not mean the strategy is wrong. It simply means that, until we change the political and moral premises on which most Americans now operate, poverty and inequality will persist at pretty much their present level."

pulsar there continually resupplies cosmic rays to produce the synchrotron radiation. But the source of charged particles in Cygnus X-3 is an enigma.

The effect on radio astronomy could be enormous. "The intriguing thing about all of this is the implication," says Hjellming. "What if the sky is filled with these flashing radio sources blinking on and off?" Only a few hundred hours have been spent looking at Cygnus X-3. The outburst was so brief that it could have been missed. "We were just fortunate to be alerted to look at it when it was doing its thing."

The history of radio astronomy is filled with reports of astronomers seeing an event. But when another astronomer looks for the same thing later, he sometimes sees nothing. "How many times have we looked at such an event and not believed it?" Hjellming asks.

Detailed data and various interpretations of the Cygnus X-3 outburst are being submitted to NATURE, where they will appear sometime in October or November. □

A flurry of legislation on the environment

After four months and some 39 closed sessions, House and Senate conferees last week reached agreement on a Clean Water Bill (SN: 4/8/72, p. 230). A committee print was not yet available at press time, but a Sept. 14 press statement appears to describe most of the important points of the compromise bill.

Senate conferees appeared to have gotten the best of a dispute over preimplementation studies of the impact of new clean water standards. The Senate version would have required no such study, while the House version insisted on a National Academy of Sciences survey and subsequent Congressional action before the standards could be "triggered" into existence. The final bill calls for a study by a 15-member executive-legislative committee (rather than by NAS) but requires no further affirmative action by Congress, thus making the study largely pro forma.

House conferees seem to have gotten the best of another dispute—over whether ridding the nation's waters of all pollution by 1985 should be a requirement or merely a "goal." The House language prevailed and the 1985 deadline is only a goal. House conferees also appear to have secured one-and-a-half- and two-and-a-half-year delays, respectively, for industrial water cleanup using first "the best practicable technology" and then "the best available technology." The dates were moved backward from early 1976 and early 1981 to mid-1977 and mid-1983.

It appears that House conferees also prevailed in a provision in the final bill that delegates authority to states for issuance of industrial water use permits and at the same time strips the Environmental Protection Agency of its present permit-by-permit veto authority.

Although, generally speaking, the House bill appealed less to environmentalists than the Senate bill, that was not so with regard to grants for construction of local sewage treatment