page 17). In the new experiments, Libchaber and Fauve used mercury and applied a longitudinal magnetic field. As they increased the field, the experimenters found that at first two modes locked, then with further increase in field the modes unlocked, and with still more field the oscillatory instability disappeared. When the modes are unlocked, a third mode is present, and noise is observed.

Guenter Ahlers (who left Bell Labs two years ago to join the Santa Barbara physics department) has started experiments with a system involving, among other phenomena, two incommensurate frequencies. He studies a fluid contained between two concentric cylinders with the inner one rotating (the Couette–Taylor system). I enjoyed watching the regularly spaced Taylor vortices slowly disappear as Ahlers varied the rotation speed of the inner cylinder.

Fractional quantum numbers. A beautiful example of the institute's interdisciplinary interactions is the work on fractional quantum numbers. Last year Roman Jackiw visited the institute and learned that his work on fractional quantum numbers in field theory was closely related to that of Schrieffer's work on solitons in polyacetylene (PHYSICS TODAY, July 1981, page 19). Meanwhile, when Jackiw's MIT colleague Jeffrey Goldstone spent some time at the theory institute, he collaborated with Wilczek on the appearance of fractional quantum numbers in various quantum field theories. Since then, Wilczek told me, he has also considered two-dimensional systems. He finds that when a particle of charge q orbits around a tube with magnetic flux ϕ, its orbital angular momentum l_z is quantized in units $l_z = \text{integer} - q\phi/2\pi$. In certain kinds of particle theories involving stringlike particles, this quantization concept means that $l_z = \frac{1}{3} + \text{integer}$.

Another application of Wilczek's idea is for superconducting vortices. For a unit vortex in a superconductor, the magnetic flux is quantized as $\phi = 2\pi/2e$, where e is the electron charge (and $2e$ the charge of the condensate). So the orbital angular momentum of an electron around a unit vortex is $\frac{1}{2} + \text{integer}$, and the composite entity is a boson. Although this result is implicit in previous work, Wilczek feels it has not been appreciated before.

Another result, Wilczek told me, concerns monopoles: He speculates that if you scatter particles off monopoles, because the baryon number of a monopole is indefinite, you might be able to catalyze baryon-number violation.

Two young theorists at Santa Barbara—John Richardson and Doug Toussaint—told me about their work with Robert Pearson (who was away when I visited). They're building a hard-wired special-purpose computer for Monte Carlo simulation of the three-dimensional Ising model. The device, IMP (for Ising Model Processor), will be able to do the Monte Carlo updating algorithm on 30 million spins per second on lattices as big as $64 \times 64 \times 64$. For comparison, they told me, a CDC 7600 can calculate 3 million spins per second. They built IMP with off-the-shelf electronic parts that cost a couple of thousand dollars. IMP will be coupled to a VAX computer, which will measure the appropriate parameter (such as magnetization, energy or correlation function) while IMP continues the next updating algorithm. Pearson, Richardson and Toussaint realize that the Ising model is fairly simple, so if they want to make special-purpose devices for more complicated models they should take advantage of VLSI technology. They're looking into so-called silicon compilers, which allow one to specify the design of a circuit at a high level, leaving the details of implementation and layout to the computer.

What of the future? When NSF asked the National Science Board to approve the founding of the theory institute, NSF agreed that in its fourth year of operation it would conduct an in-depth review of the institute's operations. The review is to evaluate the institute's effectiveness in fostering research that is not only of high quality but which would not have been done if the institute had not existed. Recognizing that the experiment could not be repeated without the institute's existence, however, NSF says the criteria should be: quality and impact of work produced by the institute, the degree to which the physics has been new and has crossed subfields within physics, the degree to which excellent potential visitors are eager to participate, and the extent to which the physics community believes the institute has made a positive contribution to American theoretical physics.

Boris Kayser, who spearheaded the founding of the theory institute and heads the theory program within the NSF physics division said (dating himself and those who know what he's talking about), "The $64 question is should we continue to fund them beyond the fifth year?" A preliminary review was made last fall by four theorist reviewers, to identify any potential problems. The full-scale review will be made this fall with about ten reviewers involved in the evaluation.

One problem the theory institute had to deal with, which is not a problem for the summers-only Aspen Center for Physics (PHYSICS TODAY, October 1981, page 54) is the difficulty in getting senior physicists to spend substantial time in Santa Barbara in seasons other than summer. Another problem may be, what do you do for an encore? After the institute has had programs in a dozen or so interdisciplinary topics, will appropriate topics be exhausted, and then can these previous programs be repeated successfully in three or four years? In reply, Kohn told me that one of the most exhilirating things about theoretical physics these days is that the subjects of interest evolve and change very rapidly. He said that five years ago almost none of the topics studied at the institute could have been predicted.

Despite the initial skepticism of many leading theorists, the institute is attracting superb scientists to its programs. As one noted theorist who had been critical of the institute at first said to me recently, "Boris Kayser was right. It's a good thing. It works. There are good people there writing good papers." —GBL

Plans for Spain to rejoin CERN

Spain has applied for readmission to CERN. The Director General, Herwig Schopper, and the President of the CERN Council, Sir Alec Merrison, have been authorized to negotiate the conditions for Spain's readmission. Spain had been a member nation from 1961 to 1968, when it resigned, saying it could not afford its share of the CERN budget, which was increasing linearly to support the construction of the Super Proton Synchrotron. The CERN budget is now flat (corrected for inflation) for the next four years while LEP is being constructed. (LEP is the acronym for the Large Electron–Positron colliding-beam device.)

Once Spain becomes a full member, its share of the CERN budget, which is roughly proportional to the Gross National Product, is expected to be 7.3%. The CERN budget for 1982 is 644 million Swiss francs. Early in April Schopper and Merrison visited Spain to negotiate Spain's contributions, which might grow step-by-step from a fraction the first year to the full contribution in five years. Although Spain has several groups participating in CERN experiments, the rationale for a step-by-step growth in contributions is that Spain wants to strengthen its particle-physics activities in the universities.

The final arrangements for admitting Spain are expected to be approved by the representatives of the present 12 member nations at the CERN Council meeting in June. —GBL□