The INT at Age Ten

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Abstract

The history of the Department of Energy’s Institute for Nuclear Theory, located on the campus of the University of Washington, is reviewed on the occasion of the INT’s tenth anniversary.

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The US Department of Energy’s Institute for Nuclear Theory (INT) began operations on the campus of the University of Washington in March, 1990. In the decade following, the INT has played an important role in helping the field of nuclear physics through a period of rapid change. With the relativistic heavy ion programs at CERN and Brookhaven, the precision electroweak efforts at Jefferson Lab, and rapid evolution of sophisticated solar neutrino experiments, the field’s frontiers have broadened to include the substructure of the nucleon, the properties of QCD at high temperature and baryon density, and the nature of physics beyond the standard model. With this evolution, the intersections of nuclear physics with sister subfields – astrophysics, particle physics, condensed matter, and atomic physics – have become both richer and more entangled. Theory in particular has profited, attracting young phenomenologists who would previously have carried some other label, and becoming enriched with new intellectual challenges like effective field theory, the pattern of neutrino masses, and color superconductivity. Thus, on this tenth birthday of the INT, it is appropriate to look back at the role the Institute has played in these changing times, and speculate on how it might continue to help the field in the coming decade.

The History

The creation of the INT was the culmination of a process begun by the Koonin Committee, a subcommittee of the Nuclear Science Advisory Committee (NSAC). NSAC, which advises the US Department of Energy (DOE) and National Science Foundation (NSF), asked the Koonin Committee to assess the health of nuclear theory and recommend steps that could be taken to strengthen it, given the coming challenges of JLab and RHIC. One of the recommendations included in its 1988 report was “…The creation of one or more nuclear theory centers. Such centers must be truly national in character, must have a significant interdisciplinary component, and must be viewed and funded as an important complement to the strengthened individual programs.” In response to the subsequent DOE announcement, five collaborations submitted proposals for establishing the INT, which were reviewed by a DOE-appointed selection committee that visited the proposed sites. In its selection of the Seattle proposal, the committee cited its strong and coherent management plan, its emphasis on young people and visitor programs, its focus on interdisciplinary problems involving nuclear physics,
and the strong local commitment. This commitment included a substantial start-up grant by the Murdock Charitable Trust and a promise by the University of Washington to create permanent quarters for the INT within its planned new building for physics and astronomy.

The INT opened in the spring of 1990 with a three-month program on Quarks and Nuclei. Ernest Henley, who had been instrumental in bringing the INT to Seattle, served as Director until September, 1991, and was succeeded by Wick Haxton, the current Director.

Both the staffing of the INT and visitor program selection were (and are) guided by the INT’s National Advisory Committee (NAC). The NAC consists of nine members who broadly represent the nuclear physics community, including areas of intersection with other physics subfields. The NAC has traditionally included several European or Asian members, who provide an international perspective and help maintain closer ties with sister institutes like those at Trento and Adelaide. New members, appointed for three year terms, are nominated by current NAC members, who seek input from the physics community, including the Division of Nuclear Physics of the American Physical Society. Nominees must be approved by the Director of the Division of Nuclear Physics of the DOE. The NAC traditionally meets each August to review program and workshop proposals received from the community, advising the Director on their timeliness and merit, and providing constructive suggestions for promising but unsuccessful proposals. The NAC chooses its own chair. Steve Koonin, John Negele, Jim Friar, Berndt Müller, and Vijay Pandharipande have served in this role. Although NAC members volunteer their time, all 30 invitations extended in the past decade have been accepted.

After assisting the University of Washington with the appointment of Haxton as Director in 1991, the NAC turned to the question of the INT’s other permanent faculty. The goal was to create a small but strong “in house” group who would have broad interests in nuclear physics and related fields, could contribute to the vigor of the INT’s visitors program, and would stimulate the postdocs and other young people working at the INT. The NAC’s 1992 search for the INT’s first Senior Fellow resulted in the appointment of George Bertsch, previously holder of the Hannah Professorship at Michigan State University. In 1994 David Kaplan joined the INT as the second Senior Fellow. David had been Associate Professor of physics at the University of California, San Diego. The INT faculty hold tenured positions
in the University of Washington Department of Physics.

This faculty hiring was a component of the five-year start-up plan for the INT that had been negotiated by the DOE and University of Washington. It paralleled similar increases in INT visitor activities, the postdoctoral program, and the administrative staff. The INT became complete with the opening of its permanent quarters in the new Physics/Astronomy building on August 15, 1994. One weekend in the middle of an aptly named summer program (Applications of Chaos), the INT moved from its temporary quarters in Henderson Hall. The new facilities included 22 offices, a seminar room, and a conference room. Most important, the INT’s immediate neighbors where now the Physics Department’s nuclear, condensed matter, and particle theory groups. This greatly increased interactions among INT visitors and the department’s faculty, and led to much more frequent participation in INT programs by department experimentalists and non-nuclear theorists. (The department’s nuclear theorists, undeterred by the four-block walk to Henderson Hall, had been active participants in the INT from the beginning.)

Much of the vitality of the INT derives from its young people. Generally the INT hosts two Fellows, young researchers appointed for five-year terms who hold the rank of Research Assistant Professor in the Physics Department. The original siting committee for the INT argued strongly for these positions: they anticipated that the visibility of the position would enhance the careers of the Fellows, and that the Fellows would help mentor the INT’s postdocs. Three of the four veterans of this position already hold tenured university positions. The current occupants are Paulo Bedaque (formerly a postdoc in the Center for Theoretical Physics, MIT) and Lev Kaplan (formerly a Harvard junior fellow).

In addition, the INT typically hosts five or six postdocs, about half of whom are supported by various international fellowships. The INT’s young people are generally quite active in the visitor programs, and have, on a number of occasions, taken lead roles in the organization of workshops. For example, Lev Kaplan teamed with INT postdoc Thomas Papenbrock to organize the INT’s March, 2000, Workshop on Complex Systems and Quantum Chaos.

The INT faculty endeavor to select postdocs based on research promise and potential for independence, and give little emphasis to the candidate’s overlap with the local research program. There is a willingness to consider
relevant talent from particle physics, astrophysics, nonlinear dynamics, and other subfields with connections to nuclear physics. The underlying philosophy is that promising, independent researchers will become intellectually engaged in our visitor and local activities, and thus in the challenges facing nuclear physics. While there is some risk in this approach, the successes appear to outweigh the failures. A large fraction of the INT’s former postdocs have already found assistant professor and staff positions in strong departments (Colorado, Minnesota, Stony Brook, Brookhaven, and Los Alamos).

Although the INT’s original plan made no provision for the faculty to supervise local graduate students, it soon became apparent that this had been an oversight. At the time of the INT’s first renewal – the supporting DOE grants cover five year periods – two inadvertent barriers to local graduate student involvement in the INT were removed. The second 5-year grant permitted the support of graduate students as research assistants and also made it easier for INT faculty to teach, if they desired. Graduate students are now a vital part of the INT research effort.

Programs, Workshops, and Schools

The three annual programs are the center of INT activities. Typically running for about three months, a program brings visiting physicists to the INT to focus on some forefront issue facing the field. Approximately one-third of the program proposals submitted by community members succeed on first submission. Successful proposers are then asked to organize their programs, helped and guided by the INT’s administrative staff, which handles matters such as visas, housing, and space and budget projections. The staff endeavors to free the organizers from as much clerical detail as possible, leaving the physicists to focus on matters requiring their scientific judgment (such as which applications to accept and which seminars to schedule).

A typical program involves 60-70 visitors (though on occasion the total has approached or exceeded 100). The average participant spends 3-4 weeks at the INT, though each program has a few key participants that remain in residence throughout the program. Weekly attendance thus is about 18, close to the INT’s capacity. There is significant participation by experimentalists, who typically visit for shorter periods. Overseas participants account for 30-40% of the total. Organizers are asked to encourage the participation of women physicists and others from underrepresented groups.
Programs attempt to provide participants with long periods for concentrated individual research and for collaborative work with others. The primary mechanism for stimulating collaborations is the morning seminar, where newcomers are quickly assimilated into the group and where many discussions begin. Small working groups often form to continue discussion into the afternoon and, not infrequently, after dinner. Participants have keys allowing access to the INT and to the physics library 24 hours a day.

The programs are scheduled for spring, summer, and fall, with a two-month break from mid-December to late February. Traditionally programs with strongly interdisciplinary themes are scheduled in the summer, e.g., subjects such as neutrino physics, effective field theory, and neutron stars. An important success of the INT has been its popularity in the general physics community, with strong participation by astro, particle, atomic, and condensed matter physicists as organizers and visitors. Summers appear to be the time when non-nuclear participants are most easily attracted to the INT.

The INT also organizes frequent shorter workshops and miniworkshops, more intense activities involving a series of seminars and working group discussions, and lasting typically from two days to a week. Some of these are organized as part of and in conjunction with programs. For example, organizers may designate the first week of a program as an introductory workshop, enlarging the program participation for that week. Others are independent of the programs. Over the last five years, an average of four such “stand alone” workshops have been held each year.

Two highly successful efforts are the JLab/INT and RHIC annual workshops. Both have a similar goal: to bring together roughly equal numbers of theorists and experimentalists to focus on specific aspects of the programs at these two major facilities. Traditionally there has been an emphasis on young researchers, both as participants and as workshop organizers. The JLab/INT series, now in its seventh year, is jointly supported by Jefferson Laboratory and the INT, with the location generally alternating between these two sites. The community is invited to suggest topics (and volunteer as organizers). The RHIC Winter Workshops, now in their fifth year, are jointly sponsored by Brookhaven National Laboratory, Lawrence Berkeley National Laboratory, and the INT. The site usually alternates between LBNL and the INT. A steering committee, comprised of BNL, LBNL, and INT physicists, is responsible for selecting topics and recruiting appropri-
ate organizers. Although originally envisioned as small and very focused workshops involving 25-30 participants, it has proven impossible to limit attendance, given the strong interest in the JLab and RHIC programs. While some of the workshops have grown to 100 or more participants, the schedule of talks is controlled so that the emphasis remains on discussions, rather than formal presentations.

The remaining “stand alone” workshops are generally one-time efforts focused on specific topics. While proposals can be made to the NAC, often workshops are approved quickly by the Director, so that the workshop lead time is reduced. As the cost of a workshop is typically 5-10% that of a program, this is a cost-effective way of addressing specific “hot topics” arising in nuclear physics. Often these workshops are organized in collaboration with outside institutes or universities. Recent examples include Harvard’s Institute for Theoretical Atomic and Molecular Physics (ITAMP) [Hyperspherical Harmonic Methods]; Caltech [Nuclear Physics with Effective Field Theory]; Santa Barbara’s Institute for Theoretical Physics (ITP) [Time-Dependent Density Functional Theory]; and Argonne National Laboratory [Pion Production Near Threshold]. In such cases the collaborating institution often provides the site and logistical support, in addition to partial funding.

In order to make the results of selected workshops available to a wider audience, the INT entered into an agreement with World Scientific to publish proceedings. The eleventh volume of the INT series is now in production. Another mode of communicating and publishing occurs via the INT’s website. Workshop transparencies can be scanned into the website. An audio option will soon be added. Applications to attend workshops and programs are now also handled online.

In addition to programs and workshops, the INT is involved in several programs that encourage students to pursue physics and nuclear physics. These efforts grew out of discussions between the DOE, INT, and NAC at the time of the DOE’s first five-year review of the INT, and reflected concerns about the declining interest of US students in physics generally.

One effort began in 1995 under the auspices of the NSF’s program, Research Experiences for Undergraduates. Undergraduates from colleges across the US, most of whom have completed their junior years, are brought to the University of Washington for a 10-week period of intensive research under the direction of a faculty mentor. The program is administered by the INT and operated jointly with the physics department’s various research groups.
The program is very popular, this year generating about 230 applications for 12 positions, with an acceptance rate of nearly 90% for first offers. Now in its sixth year, the program has served more than 80 students, about half of whom have chosen to do projects in nuclear physics. One interesting demographic is the large number of applications from women: nearly 40% of our REU students are female. Approximately 20% of the class later returns to graduate school at the University of Washington, and many others are doing advanced studies elsewhere. One goal of the program is to introduce students to nuclear physics in the hope that this will influence future education and career choices.

A second effort is the National Summer School in Nuclear Physics, now in its 13th year. Sponsored by the NSF, the school is intended for advanced graduate students and beginning postdoctoral researchers. Community members volunteer to host and organize the school. There is a steering committee, selected by the Executive Committee of the Division of Nuclear Physics, American Physical Society, that is responsible for oversight.

Following an unfortunate cancellation of one school seven years ago, the steering committee invited the INT to take over the school’s administration, hoping this step would help stabilize the effort. This administrative help – secretarial support, advertising, mailing, and poster production, etc. – is provided through the INT’s DOE grant. The INT has also hosted the school twice. The INT has pledged to continue its support through at least 2004. The school attracts 40-50 students each year. The year 2000 school will be held July 3-14 on the campus of the University of California, Santa Cruz.

Outlook at Age Ten

The scale of activities at the INT, ten years after its founding, is remarkably different from that envisioned in the original proposal. That proposal described three annual programs attracting approximately ten visiting scientists each. Today the INT attracts 350 visitors each year. The list of Affiliates – previous visitors and those wanting to be kept informed of INT activities – now numbers nearly 2000. (Many of these are younger researchers, an emphasis of the INT that was envisioned in the original proposal.) The strength of the participation by physicists from other fields, from overseas, and from experiment was not foreseen. Nor was the community’s enthusiasm for the INT’s topical workshops, many of which are organized collaboratively with
other institutes, laboratories, and universities. Finally, the original proposers wondered how long the community could support three annual programs. Yet the INT receives an average of ten program proposals each year, the quality of which has risen steadily. The INT’s most common problem is its inability to accommodate the numbers of applicants who wish to attend the programs.

The success of the INT – as well as that of its European counterpart the ECT* – likely results in part from a sound “formula” and in part from changes in the way nuclear physics is now done. The INT’s emphasis on the intersections with other fields and on collaboration resonates with the changes occurring in our field due to JLab, RHIC, and SNO. These facilities address issues relevant to nuclear, particle, and astrophysics. There is much anecdotal evidence that the INT’s efforts to expose this physics to a wider community has led to a broader appreciation of our field. Similarly, the theory questions arising from the new facilities are often far more complex than those of previous times. The INT’s emphasis on collaboration - among theorists and with experimentalists - has helped theorists focus their collective energies on difficult but crucial questions.

The INT has evolved in ten years from an interesting experiment to one of the institutions most responsible for the renewed optimism in our field. Its success derives from the support it has received from the community, from the program proposers who offer their ideas, from the participants who “vote with their feet” by coming to Seattle, and from DOE program officers who were willing to back this experiment with consistent funding. The INT will endeavor to respond as the community’s needs continue to evolve, and as our field moves forward.

Readers who would like to learn more about the INT – from its history to its current and future programs and workshops – are invited to visit its web site, http://int.phys.washington.edu.