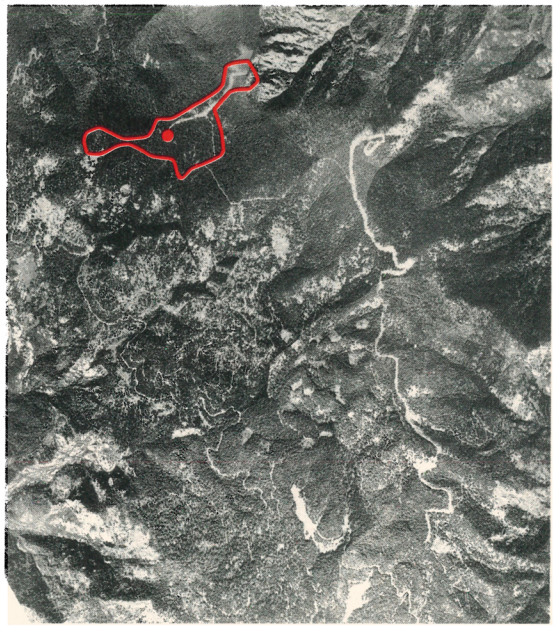
COURT TO DECIDE FATE OF MT. GRAHAM OBSERVATORY THIS WINTER OR SPRING

For nearly a decade now astrophysicists and telescope designers at the University of Arizona have been collecting and storing their acorns, in eager anticipation of the day when construction could begin of a new observatory on Mount Graham, 80 miles northeast of Tucson. The observatory is to be the home for at least three telescopes, all in very advanced stages of planning: Since the beginning of this year, a 1.8-meter optical telescope built by the Vatican Observatory in collaboration with the University of Arizona has been languishing in a Tucson hangar; a 10-m submillimeter radiotelescope built by the Max Planck Institute for Radioastronomy has been sitting in boxes in Germany, ready to be shipped; and conceptual design work has been completed for an optical telescope, which will employ two 8-m spun-glass mirrors that are to be cast in a new $20-million facility built by Roger Angel and his group at the University of Arizona. The so-called twin shooter, dubbed Columbus, is a collaboration of the University of Arizona, Ohio State University and Italian astrophysicists associated with the Arcetri Observatory.

Stalled by a bitter controversy over an endangered species, the Mount Graham red squirrel, preliminary construction of the Mount Graham International Observatory has repeatedly been started, only to be stopped in its tracks by government intervention or court injunctions. Meanwhile, the international partners in the three telescope projects have become increasingly restive.

The controversy over Mount Graham has cast Arizona astrophysicists in the uncomfortable position of being seen as "pro-development" or "anti-ecological." Of course many of the astronomers consider themselves to be committed environmentalists, and probably all of them think of themselves as lovers of nature. Nonetheless, some of them feel strongly that opponents of the observatory have done great violence to scientific truth in their zeal to stop the project; at stake, they feel, is the whole tradition and future of Earth-based optical astronomy in the Southwestern United States.



Initial telescopes will be built on Mount Graham, if authorized by the courts, on a three-acre site demarcated by the red dot at the upper left of the photograph. Area delineated by the red line represents the whole 150-acre research site, within which four more telescopes could be built under Federal law, provided that the first three telescopes are found to coexist satisfactorily with the red squirrel.

Speaking on 7 September, the day a Federal court of appeals in San Francisco was due to make a ruling on whether construction of the observatory could proceed, Angel said: "The United States has a tradition of doing astronomy in the Southwest, and it is not by accident that Arizona now has a lot of leading instrumentalists. But every existing site in the Southwest is defective. And so if we don't get Mount Graham, we can see the end of that tradition—that's what's at stake in Federal court this morning."

Speaking with equal feeling, Paul Hirt, a spokesman for the Sierra Club Legal Defense Fund, dismissed with an expletive the argument that Southwest astronomy hinges on Mount Graham. He noted, for example, that Germany's submillimeter telescope originally was destined for Mount Lemmon—still a suitable site, he implied. As for the Vatican telescope, he said that it is not an important new-generation telescope, and he said that it too does not have to go on Mount Graham. Hirt claimed that the Vatican had been brought in just because the University of Arizona wanted to create a bandwagon for the Mount Graham project. "Is the prestige of the University of Arizona worth sacrificing the most unique mountain range in the Southwest?" he asked.

Tangled history

Planning for the Mount Graham observatory started in the early 1980s and by the mid-1980s was meeting with vehement opposition from a coalition of environmental, wildlife and hunting groups, who found sympathetic allies in the US Fish and Wildlife Service and the US Forest

Service. Nearly 40 local and national groups formed the Coalition to Save Mount Graham, which included the Arizona Wildlife Federation, all five local chapters of the Tucson Audubon Society, the Sierra Club, the Defenders of Wildlife and the National Wildlife Federation.

Hirt characterizes Mount Graham as an isolated mountain island separated by a sea of desert: Elevated valleys separate large looming ranges, and with every thousand feet or so of elevation, completely different "life zones" are found—first desert grassland, then scrub oak, then ponderosa pine and mixed conifer, and finally spruce and fir. Hirt says that the top of Mount Graham hosts the southernmost spruce/fir forest in that part of the country, and that it is an almost perfectly preserved vestige of the Pleistocene, in which species have been evolving in isolation for 11 000 years. Among them are three animals that exist nowhere else: the Mount Graham pocket gopher, a white-bellied vole and the Mount Graham red squirrel.

In 1988, after the Fish and Wildlife Service finally gave the project a go-ahead provided a long list of conditions were met by the University of Arizona, Congress enacted legislation authorizing construction of the observatory. The legislation permitted construction of three telescopes initially, with up to four more to follow, if the Mount Graham red squirrel was found to be adequately protected during construction of the first three. In effect, the legislation declared the project to be in compliance with the Endangered Species Act but left it open to challenges under the National Environmental Policy Act.

The University of Arizona proceeded with construction of a feeder road to the observatory site—a highway already existed on the mountain, which attracts some 300 000 visitors a year to the lower elevations. But in March this year, opponents of the project persuaded a Federal District Court to grant an injunction blocking the project, pending a second look at it by Congress. A week later, after a Congressional hearing was scheduled and Congress's General Accounting Office was ordered to produce a report on complaints made about the Fish and Wildlife Service, a US Circuit Court of Appeals in San Franciso overturned the injunction.

At the end of August, the Forest Service declared on advisement from the Justice Department that the project could proceed and that the red squirrel had been adequately studied. Opponents once again went to court, arguing that Congress had not had an opportunity to act on the GAO report, which was very critical of the Fish and Wildlife Service's decision making. This time the District Court declined to intervene, having been chastised the time before by the Appeals Court.

In a rapid series of decisions in September, the Ninth Circuit Court first imposed a 10-day stay, so that it could study the claims and counterclaims of opponents and proponents; then extended the injunction until December, when it would hear the case; and then lifted the injunction, permitting the University of Arizona to proceed with installation of the first telescopes, although it still will hear the case in December.

The instruments

By the end of the first week in October, the University of Arizona cleared the sites for the submillimeter and Vatican telescopes. It was hoped that all ground preparation work would be completed before the winter snow set in. Installation of the two telescopes could begin as early as next summer.

According to Peter A. Strittmatter, director of the Steward Observatory at the University of Arizona, the Vatican telescope—though small—will have the fastest optics of any current optical telescope. Its focal length is equal to the diameter of the mirror, an unprecedented achievement permitting it to be housed in a highly maneuverable cubic structure. "I believe that the Vatican telescope, if successful, will be the prototype for all future [optical] telescopes," Strittmatter says.

The submillimeter radiotelescope, built by Krupp and MAN, is one of several important submillimeter instruments that are opening a new era in radioastronomy (see PHYSICS TODAY, August 1987, page 65). It makes extensive use of carbon-fiber-reinforced plastic in both the reflector panels and structural parts, and it will be shielded by a co-rotating enclosure of a novel barnlike design. Under the supervision of Robert Parks at the University of Arizona's Optical Sciences Center, the reflector panels were replicated from molds cast of Pyrex that were ground to surface accuracy of 3 microns. Each of the primary reflector's 60 panels is a composite with an aluminum honeycomb core bonded top and bottom to carbon-fiber-reinforced plastic. The primary reflector is to have a surface accuracy of 15 microns rms, which would permit detection of submillimeter radiation at the atmospheric limit.

While the materials and techniques mustered for the new radiotelescopes represent a great leap forward, at least one wag has characterized the optical mirror technology developed by Angel and associates as "a great leap backward." That is because the mirrors, from one point of view, represent an extension of the honeycomb technology used for the Palomar mirror. The extension is dramatic, however, and has had a huge impact on planning for future optical telescopes.

The Columbus twin-shooter is to be equipped with the first of Angel's 8-m light and rigid honeycomb mirrors. (The first of his 3.5-m mirrors is slated for a telescope on Sacramento Peak, New Mexico, currently being built by a consortium of Princeton University, the University of Chicago, the University of Washington and Washington State, and the University of New Mexico.) Columbus will have a baseline of 22 meters and an effective light-gathering area of 11.2 meters.

Peaceful coexistence?

When Arizona astronomers first contemplated a new observatory in the early 1980s, they gave some consideration to a site on Chiricahua Peak, which might have been marginally superior to Mount Graham as a telescope site. But Chiricahua was even more pristine, in that it had no road, and it was already a designated wilderness and therefore undevelopable.

Mount Graham had a road, and in the course of the long controversy over the observatory and the squirrel, the university managed to build a feeder road to the observatory site. The feeder road represents 65% of the installation's "footprint" and 90% of its environmental impact, Strittmatter claims—90% because the circular base for the telescopes affects proportionally less contiguous area. Strittmatter says that the observatory will impinge on only one-sixth of one red squirrel's habitat.

The rejoinder from Hirt is that the observatory will go right into the core of the squirrel's best habitat area, and that the species population—estimated at around 150 at present—already is below what is considered a minimum viable population. Such are the claims and counter-claims that now will be heard by the Ninth Circuit Court in San Francisco.

The court is consolidating five appeals connected with Mount Graham, gathering materials from all parties. A panel of judges will be assigned to the case in December, and that panel could issue a ruling as early as March. The University of Arizona hopes that

the decision will be made no later than July. Meanwhile biologists for the University of Arizona and the US Forest Service will be keeping close tabs on environmental consequences, and by next spring, we should have a reading on the respectives fates of the red squirrel and the Mount Graham Observatory.

—WILLIAM SWEET

IUPAP RECOGNIZES BIOLOGICAL PHYSICS, ELECTS YAMAGUCHI

MIT's Mildred Dresselhaus, the head of the US delegation to this year's meeting of the International Union of Pure and Applied Physics, says she often hears it said that "IUPAP is good at getting information from the troops, but the troops don't seem to get much information about IUPAP."

IUPAP does indeed seem to be an important but somewhat obscure and quite unusual organization. Its triennial general assembly meetings attract an extremely elite representation of physicists, who occupy themselves during the working hours of the conferences with the deadeningly mundane tasks of organizing commissions and electing new officers. Yet in the breaks between meetings and in the evening hours, the atmosphere pulses with the excitement of high politics, and one senses that deals are being made that will have surprising effects years later.

Three years ago, when IUPAP's 19th general assembly meeting took place in Washington, DC (in association with the Corporate Associates meeting of the American Institute of Physics), the outgoing president was D. Allan Bromley, who one year later would be named science adviser to President Bush. The newly elected president-designate was Yuri Ossipyan, who two-and-a-half years later would be named science adviser to President Gorbachev.

At that meeting it was decided to hold the next general assembly in Dresden, East Germany, where—or so it is widely believed—the first shot of the Cold War was fired in February 1945. When the meeting actually took place at the end of September this year, the Cold War had just been officially declared over, and a divided Germany was about to be made one again. It was a very historic moment, as Dresselhaus said in a written report after the meeting: "Both optimism and uncertainty dominated the air, and the topic of German unification was frequently discussed, both in terms of physics and in a broader sense, starting with the opening address. . . ."

IUPAP's business

Politics apart, what makes it worthwhile for a physics leader to spend three or four days every three years at an IUPAP meeting? First of all, says Praveen Chaudhari of IBM, there are the conferences sponsored by IUPAP, which over the years have become increasingly prestigious. "Sponsorship by IUPAP has come to assure a certain minimum quality," Chaudhari told PHYSICS TODAY at Dresden.

Second, said Chaudhari (who will become head of the US IUPAP delegation in January 1991), largely because of the reputation its conferences have acquired, IUPAP has come to be capable of leveraging access to countries that otherwise are closed to outside scientists, and of leveraging travel visas for scientists otherwise confined to home.

IUPAP is part of the International Council of Scientific Unions, which was founded in 1931, at a time when racism was rampant in the world, on the basis of strict racial nondiscrimination in the scientific communities. A well-known and well-regarded organization all over the world, ICSU currently has 20 member unions such as IUPAP and the International Union of Geodesy and Geophysics, and its principal activities include sponsorship of interdisciplinary research programs and conferences, production of publications and development of standards and nomenclature. In some parts of the world (if not currently in the US and UK), IUPAP also benefits from its association with UNESCO, which since 1946 has provided a little bit of funding for IUPAP-sponsored conferences.

Like other member unions of ICSU, IUPAP establishes commissions to oversee fields it deems worthy of conferences—and, by implication, of government or industrial support. Based on the commissions' recommendations, IUPAP sponsors about 30 meetings per year.

Perhaps the most noteworthy thing that happened at the Dresden meeting was the designation of a new commission for biological physics. The proposed mandate for the new commission said, "Biophysicists come from both the physical and biological sides and very often have a far better training in biology and biochemistry than in physics. The goal of *biological physics* is the exploration of the concepts and laws that underlie the structure and function of biological systems. Biological physicists most often are physicists by training."

Hans Frauenfelder of the University of Illinois, Urbana–Champaign, was elected chairman of the new commission. Frauenfelder, who also is chairman of the governing board of AIP, originally was a nuclear physicist who came to biological physics via research using the Mössbauer effect. His main interest is the dynamics, or what he calls the "energy landscape," of proteins. That is, he studies the energy changes that accompany transformations of protein structure.

This year's meeting also considered a motion from the South African delegation to establish a commission on "physics of the Earth," which would embrace environmental physics, minerals physics, cloud physics, aerosol physics, atmospheric physics and ionospheric physics. The general assembly declined to establish a commission but recommended that the IUPAP council give physics of the Earth special attention, and it noted that many activities relevant to the field could be explored and promoted under the aegis of C10, the commission on the structure and dynamics of condensed matter.

Leadership changes

The outgoing president of IUPAP is J. Larkin Kerwin, a space physicist at L'Université Laval in Québec, Canada. During his three-year tenure Kerwin reviewed and rewrote the mandate of every international commission, and the new mandates were adopted by the assembly in Dresden. Kerwin has been a senior officer in a succession of positions in IUPAP since 1963, when he was elected associate secretary general.

In his opening address to the assembly in Dresden, Kerwin reminded his distinguished audience of how we are seeing come true, in just one generation, the visionary expectations outlined in a US Congressional report in 1959—"marvels such as manned spaceflight, meteorological and other remote-sensing satellites, space-based systems for planetary navigation, permanent space stations and manned expeditions to other planets."

The newly elected president-designate of IUPAP is the Japanese particle physicist Yoshio Yamaguchi, who will take office in three years, succeeding Ossipyan. Yamaguchi is a theorist who independently of Murray Gell-Mann and Yuval Ne'eman applied the SU(3) symmetry group to the