periodic crystals, nor a glass-like mess of disordered atoms. They were what Shechtman had seen in his metallic alloy.

Other examples soon flooded in from around the globe. In 2009, Steinhardt and other researchers reported the first quasicrystal structure to be seen in a natural material: an alloy of aluminium, copper and iron reported to have come from 200-million-year-old rocks in Russia's Koryak Mountains (L. Bindi *et al. Science* **324,** 1306–1309; 2009).

It still isn't clear how atoms assemble into quasicrystal structures, and the discovery has found few real-world applications. However, quasicrystals do have potential: they are very hard, are poor at conducting heat and electricity, and have non-stick surfaces. But Shechtman's key contribution to chemistry lies in opening scientists' eyes to the possibility of new forms of matter, notes Sven Lidin, an inorganic chemist at Stockholm University and a member of the Nobel Committee for Chemistry. As Lidin wrote in his description of the award: "The discovery of quasicrystals has taught us humility." ■

CHEMISTRY'S LONE HEROES

How many prizewinners does it take…

Dan Shechtman got the chemistry Nobel prize all to himself this year — something that has happened in 61% of all chemistry Nobels, but only in 45% of Nobels in physics and 37% in medicine. As large teams and international scientific collaborations come to dominate research, the Royal Swedish Academy of Sciences is likely to find itself bumping up against the rule that the Nobel prize can be awarded to no more than three people in any one discipline — and the strain is already evident (see chart). Since 2000, the three scientific Nobels have been won by the maximum possible number of nine researchers on five occasions.

ASTRONOMY

Sun-watchers hope giant telescope will get green light

Observatory would reveal structures that trigger sunspots and space weather.

BY ERIC HAND

Close and bright though it is, the Sun still defies a thorough understanding. One reason is that some of the features on its roiling surface are too small and short-lived to be studied even by the world's largest solar telescopes.

That will change if the US National Solar Observatory (NSO) proceeds with its latest project — the Advanced Technology Solar Telescope (ATST), a Sun-gazing behemoth due to be built on the summit of Haleakala, the highest peak on the Hawaiian island of Maui. This month, an officially appointed arbiter will weigh the scientists' goals against objections raised by conservationists and Native Hawaiian groups to decide whether the US$298-million project can break ground later this year.

With more than twice the aperture of existing solar telescopes (see 'Eyes on the Sun'), the 4-metre ATST will be large enough to tease out small structures on the Sun, particularly magnetic flux tubes — the hitherto unseen precursors to sunspots. Sunspots, in turn, give rise to giant coronal loops and flares, which can unleash bursts of radiation and cause magnetic disturbances that sometimes threaten spacecraft, communication networks and power grids.

Heliophysicists say the improved resolution should help solar science to move into the challenging terrain of predicting space weather. "The societal need is really driving this community," says Thomas Zurbuchen, a solar physicist at the University of Michigan in Ann Arbor, who is vice-chair of a decadal survey for heliophysics that is due to release its research priorities next March.

"Societal need is really driving this community."

Although not the only phenomenon the ATST will explore, flux tubes are of especial interest because these short-lived, 100-kilometre-scale features are thought to be conduits of magnetic field lines through the solar surface. Studying them as they evolve should shed light on larger-scale solar phenomena that can affect Earth. "If you want to understand coronal heating and solar-wind acceleration, then you have to understand these fundamental scales," says Todd Hoeksema, a solar physicist at Stanford University in California.

Ultimately, solar astronomers hope to monitor the Sun 24 hours a day using a global network of telescopes. A European telescope of similar size is planned for the Canary Islands, and India is considering a 2-metre instrument. But the ATST will be built first if it passes a final hurdle.

Last December, more than seven years after the NSO chose the site, Hawaii's Board of Land and Natural Resources gave permission to develop it. A group called Kilakila O Haleakala ('Majestic is Haleakala' in Hawaiian) has contested the decision. An endangered seabird, the Hawaiian petrel or 'ua'u (*Pterodroma sandwichensis*), nests near the proposed site. Furthermore, some Native Hawaiians say that the telescope's stark white enclosure — necessary to control heat-induced air currents within the scope's optical path — will scar a sacred area. But the telescope builders say they will do all they can to mitigate the impacts. Construction

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K. WILLIAMS/ALAMY

The summit of Haleakala in Hawaii will gain its largest telescope yet if plans are approved.

workers will limit vibrations that could collapse the petrels' burrows, and will receive 'sense of place' training to avoid culturally insensitive missteps.

Honolulu-based lawyer Steven Jacobson, the arbiter appointed by the board to re-evaluate the permit, says that he will hand in his recommendation in the next week. NSO director Stephen Keil is cautiously optimistic that Jacobson will give the telescope the green light — although he has seen the process take plenty of detours before. "It keeps me awake every night," he says. "This is part of doing business in Hawaii."

There are other issues to be resolved — not least whether the cash-strapped National Science Foundation can find enough money. A $146-million infusion from the 2009 stimulus-package fund has paid for early work on the telescope's mirror. But Keil says the project will need "make up" funding of around $30 million a year — six times the amount it received in 2011 — if it is to begin operations by 2018 as planned.

By then, a new solar clearing house will be ready to receive data from the telescope. On 30 September, the board of the Association of Universities for Research in Astronomy, which oversees the NSO, announced that the observatory's headquarters are to move to the University of Colorado at Boulder. The move, planned for 2016, will spell the end for the NSO's current homes in Sunspot, New Mexico, and Tucson, Arizona, and for the ageing solar telescopes at the two sites. Administrators hope that the consolidation of staff and resources, coupled with the anticipated power of the ATST, will usher in a new era for the field, allowing astronomers to see the Sun in an entirely new light. ■

EYES ON THE SUN

The largest current and proposed solar telescopes.

MCMATH-PIERCE TELESCOPE

APERTURE: 1.6 metres
LOCATION: Kitt Peak, Arizona
FIRST LIGHT: 1962

SWEDISH SOLAR TELESCOPE

APERTURE: 1 metre
LOCATION: La Palma, Spain
FIRST LIGHT: 2002

NEW SOLAR TELESCOPE

APERTURE: 1.6 metres
LOCATION: Big Bear, California
FIRST LIGHT: 2009

GREGOR

APERTURE: 1.5 metres
LOCATION: Tenerife, Spain
FIRST LIGHT: 2012 (expected)

ATST

APERTURE: 4 metres
LOCATION: Haleakala, Hawaii
FIRST LIGHT: Proposed

NATIONAL LARGE SOLAR TELESCOPE

APERTURE: 2 metres
LOCATION: Ladakh, India
FIRST LIGHT: Proposed

EUROPEAN SOLAR TELESCOPE

APERTURE: 4 metres
LOCATION: Canary Islands, Spain
FIRST LIGHT: Proposed

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