NORTH HAWAII NEWS

SERVING ALL OF NORTH HAWAII

FREE THURSDAY, OCTOBER 11, 2001

Keck's controlled confusion

MICHAEL DARDEN / NORTH HAWAII NEWS

Interferometry: the sum greater than the whole

Dressed in clean room garb, Jet Propulsion Laboratory scientist Dr. Gerard van Belle is reflected off transport optic mirrors, part of the Keck interferometer system. Light captured by the two Keck telescopes travels through a series of tunnels and pipes, beneath the observatories, and bounces off numerous mirrors before it is collected and analyzed.

PAGE 10

THIS WEEK

Finding a niche

North Hawaii artist changes his life for the better.

PAGE 4

KFC comes to isle

New restaurant will open in Parker Ranch Center in spring of 2002.

PAGE 13

Gun safety

Tips to live by when owning a firearm.

PAGE 9

Passing the torch

Five Mountains gets new executive director.

PAGE 16

INDEX

The Great White Squid

BY CHRIS DUNLAP
NORTH HAWAII NEWS

Your long wait is over; there is an answer to the question that's been tormenting you day and night: Would a basketball-sized neutron star in the KTA parking lot have enough gravitational force to consume North Hawaii? Keck's Director, Fred Chaffee, and Jim Beletic, Deputy Director of interferometry nod simultaneously: yes.

The Big Island?

Yes.

The earth?

A slight hesitation, then Yes.

The sun?

No.

Phew! At least, as Wallace Stevens puts it "...the nothing that is not there/ and the nothing that is" would be kept warm.

An interview with two of the world's top astronomers was a perfect opportunity to speculate on such critical matters while pursuing other, more mainstream extraterrestrial subjects; however, apparently wacky ideas are perfectly at home in astronomy, and they will be addressed as space - which gets bigger every second - permits.

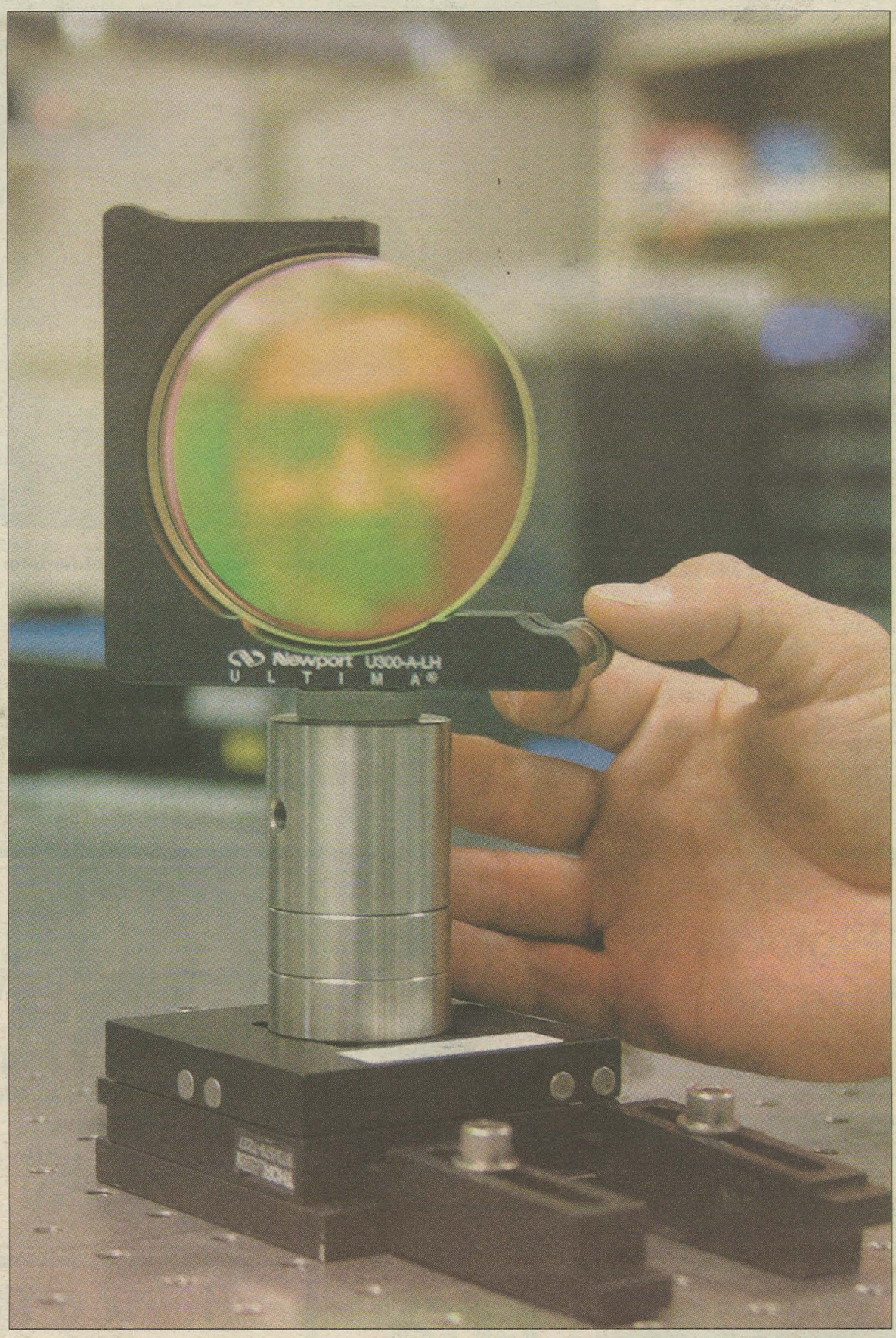
Chaffee has a Ph.D. from the University of Arizona; he was the Director of a multi-mirror astronomy program in Arizona for 12 years, and the Keck Director here since the observatory opened in 1996. Belectic holds a Ph.D. from Harvard; before coming here in May 2000 he worked with the European Southern Observatory, which has an important telescope in Chile.

There are very interesting things going on in the Keck observatories, where scenarios like the one already described are taken seriously. But that was an easy one compared to what a new technology called interferometry might reveal: the presence of embryonic planetary systems in the form of discs of dust wrapped around the waist of a variety of stars, some like our own. To call it a search for life might be too simplistic, but any search looking for orbiting debris is going to find planets "incidentally." In the last decade, the roster of known planets has gone from none to over 50; it would seem to be only a matter of time before one capable of harboring life in some form will be found, and it's possible that Keck could be the observatory that does it with either their deep-space mission or interferometry.

"Interferometry" is called such because the light waves from the various mirrors are "interfered with," or adjusted to collect a smaller but more detailed image of what's under observation.

It also involves a concept familiar to Hawaiians: outriggers.

The project involves the construction of six 1.8 meter "satellite" mirrors placed at strategic positions around the two 10-meter mirrors already in place. From above, this might look like a huge squid with six tentacles, though the arms connecting them will be underground.



MICHAEL DARDEN / NORTH HAWAII NEWS
Fringe tracker dichroics split the light into its red and blue wave lengths. The color components are then used to measure and maintain alignment between the two telescopes.

The principle involved is deceptively simple: starlight gathered by all eight mirrors is combined in such a way that the clutch of little mirrors will mimic the performance of a much, much larger mirror - spokes in a wheel, directing starlight into a hub and producing images far sharper - ten-fold over what's now possible - revealing details that suggest the gestation and even the nativity of new solar systems.

"Behind all of this is the philosophical underpinning that other solar systems exist," says Chaffee.

An analogy: suppose one skates across a one-yard diameter circle scratched into the ice: on every pass, a little of what's under the surface is revealed; skate over it a thousand times and you'll open up everything underneath. Now: each pass of a interferometer telescope crosses a mirror's aperture, establishing what Beletic calls a base-line - a line in the "ice." To someday skate over the entire circle, or enough of it to determine which rings of dust bear closer examination is, in a sense, Beletic's goal.

Wacky idea number two: if the universe is expanding, what is it expanding into? There has to be "space" for space. Imagine a loaf of baking raisin bread: the universe is the growing loaf, and our planet a raisin. But still, the loaf has the "box" of the oven to expand into. And the oven has the kitchen to expand into, and....

"You have to think outside the box," says Chaffee.

Well, that explains everything, right?

If you've ever wondered why there are two Keck telescopes, this is the reason: the light from each can be combined into one more intense beam - a sort of "one plus one equals three" technology. The concept was made fact in the 1930's, when an astronomer named Michelson successfully combined the light from two sources. Since then successful interferometry has been done many times, but never on the scale of the Keck project.

"The ESO is building a large interferometer too, " says Beletic, " but we're a year ahead of them."

The two Keck telescopes and the science of interferometry already provide dust imagery (pictures of nascent solar systems) far beyond what has been done heretofore; the outrigger mirrors will increase the facility's ability ten-fold. Though a larger base line outrigger interferometer is planned for the observatory on Mt. Wilson in California, Keck, with its full complement of six smaller mirrors and hence more base lines, will have a much more complete and powerful imaging capability, as it will simulate a huge mirror. There will be nothing like it in the world.

Just the two interferometer scopes functioning on the mountain at this moment, without the outriggers, achieve resolution quality forty times what Hubble can do - though the field of view is, of course, much, much smaller. But this is of no concern to Keck; why would they want to do the same thing, when they have the facilities to do the frontier research in an extraordinary adventure?

There will be nothing like it in space either: the National Aeronautics and Space Administration (NASA) and other organizations intend to build an orbiting interferometer at some point in the future.

It must be noted that however ambitious and profound Beletic's interferometric baby might be, ninety percent of the demands on the Keck telescopes are for other, deep-space purposes.

NASA's agenda is even more ambitious: orbiting outriggers with prisms to search for elements associated with life, like methane. And though NASA came into the project late, joining the California Institute of Technology and the University of California, it has become a principal source of funding.

"This is an entirely new technology," says Beletic. In a perfect world with infinite funding, he explains, there would be a completely filled aperture - in other words, a gigantic mirror. The Keck interferometer is a "partially filled aperture," he says, "providing far more baselines through the aperture's circumference" -- a filling in of the disc's area. In a sense, this makes a saucer believe it's a dinner plate.

"The purposes of the interferometer will be four-fold," says Beletic: "nulling, the spectroscopy of "hot Jupiters," astrometry and high-quality resolutions for imagery."

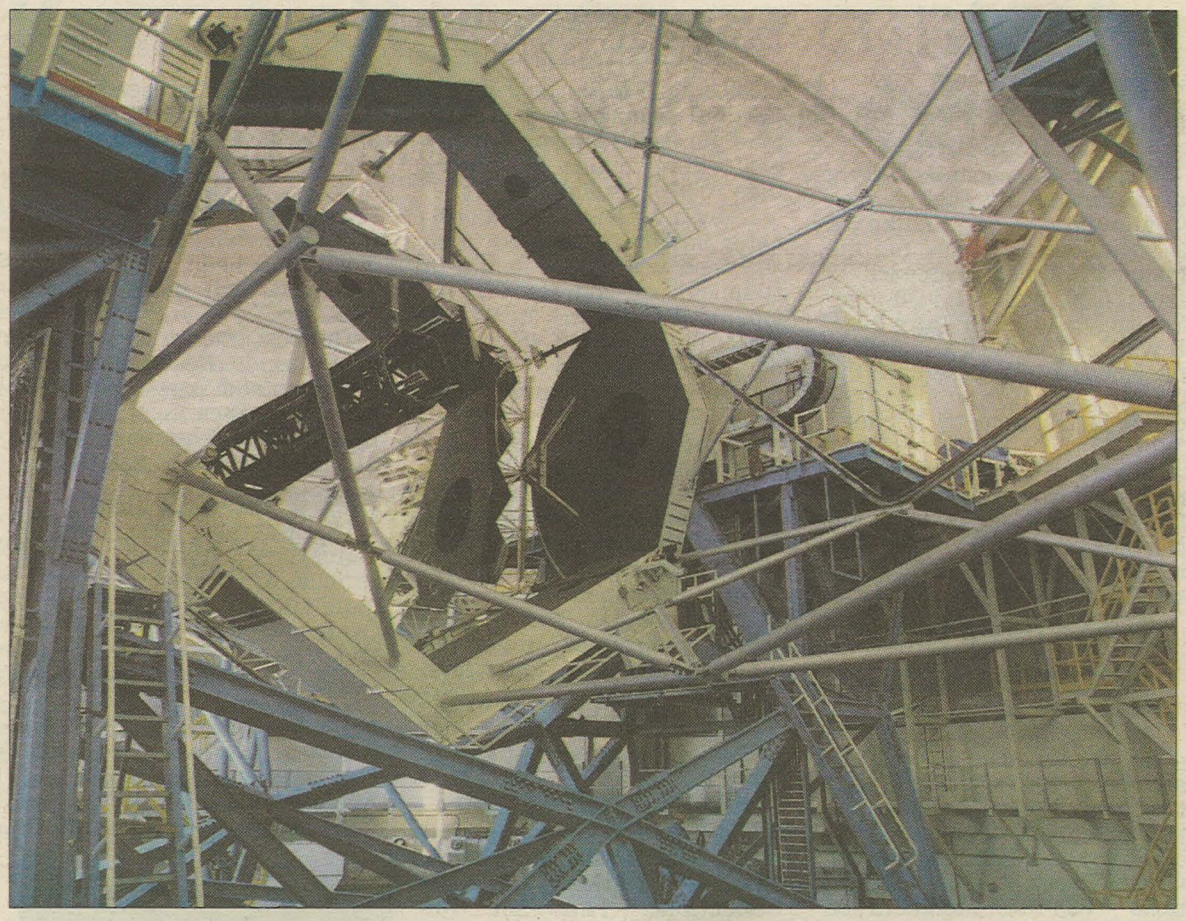
Got that? Great. Let's go on to Einstein's Special Theory of Relativity.

No, no; we aren't going there, as people say these days. Well, not yet.

"Nulling" refers to the essential nullification, or mitigation of a star's light. Without nulling, the star's brightness would compromise attempts to find dust indicating the presence of an evolving solar system.

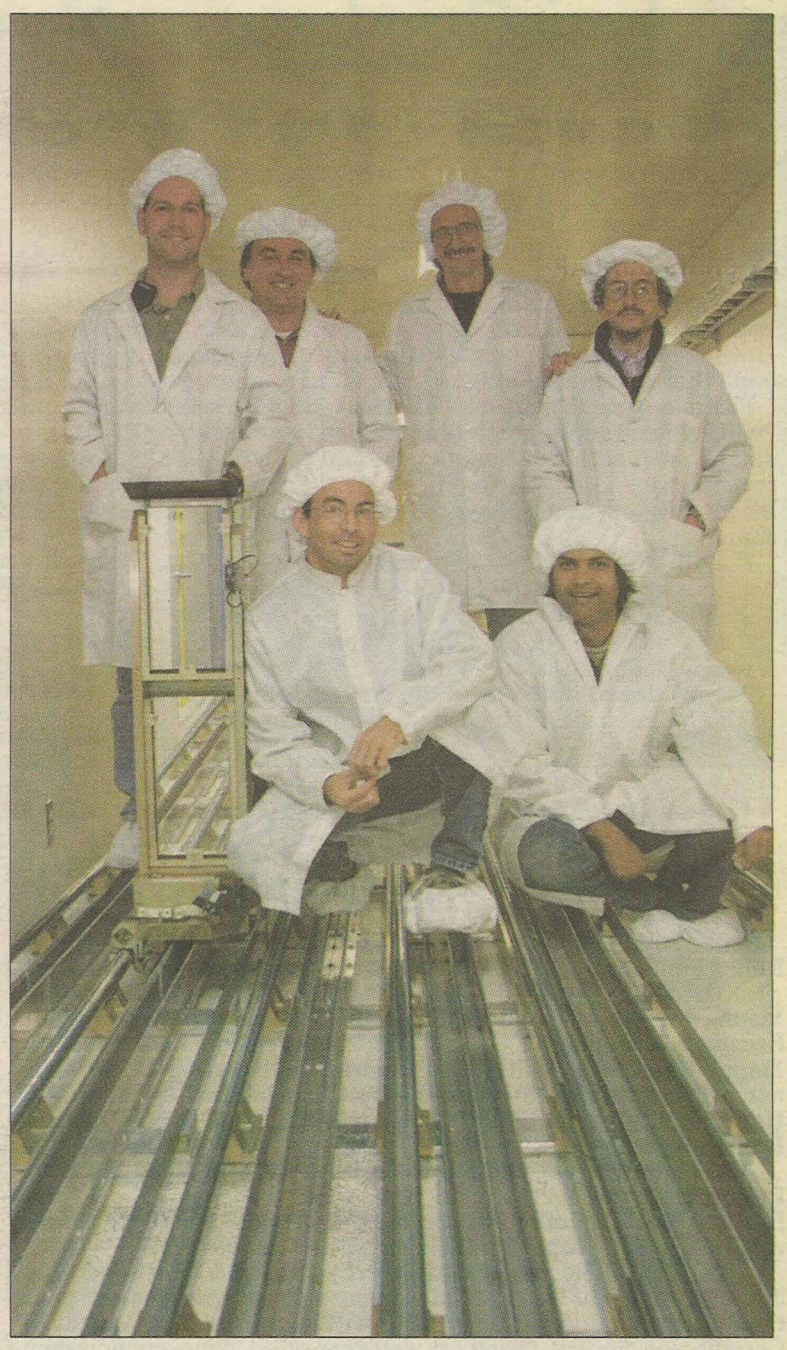
The spectroscopy involves the interpretation of white light after it is passed through a prism; every element produces a signature waveband when heated to incandes-

•SEE KECK PAGE 11



MICHAEL DARDEN / NORTH HAWAII NEWS

The Keck ten meter telescopes are already the largest optical telescopes in the world. Once they're combined, astronomers will be able to see deeper into space than ever before.



MICHAEL DARDEN / NORTH HAWAII NEWS

The Keck Interferometer Development Team, (clockwise from upper left) Gerard van Belle, Michael Hrynevych, Peter Wizinowich, Mark Colavita, Gautam Vasisht and Robert Ligon shown in one of the interferometer basement tunnels. Tunnels which run the entire length of the basement between the two telescopes contain mirrors on rails which can be moved and positioned allowing precise alignment of the starlight from the telescopes.

• Keck CONTINUED FROM PAGE 10

cence, so light coming from a "hot Jupiter" sized source will tell an astronomer what the source is made of. If the interferometer found elements believed necessary for life, like methane and carbon dioxide, the implications would be profound.

"If," your science teacher says," the Sun was the size of a baseball, the Earth would be the size of a 'bb' a hundred feet away..." Most readers will have heard this at some point in their education, and this is largely what astrometry is about: determining distances and sizes. The parade of planets beginning the movie "Contact" is a rough draft of this, if you will. Measuring and understanding cosmic distances is what astrometry is all about.

Imagery: "We make light from the various mirrors run around - we interfere with it - and then bring it together again, producing a beam of light one ten-thousandth the diameter of a human hair," says Beletic.

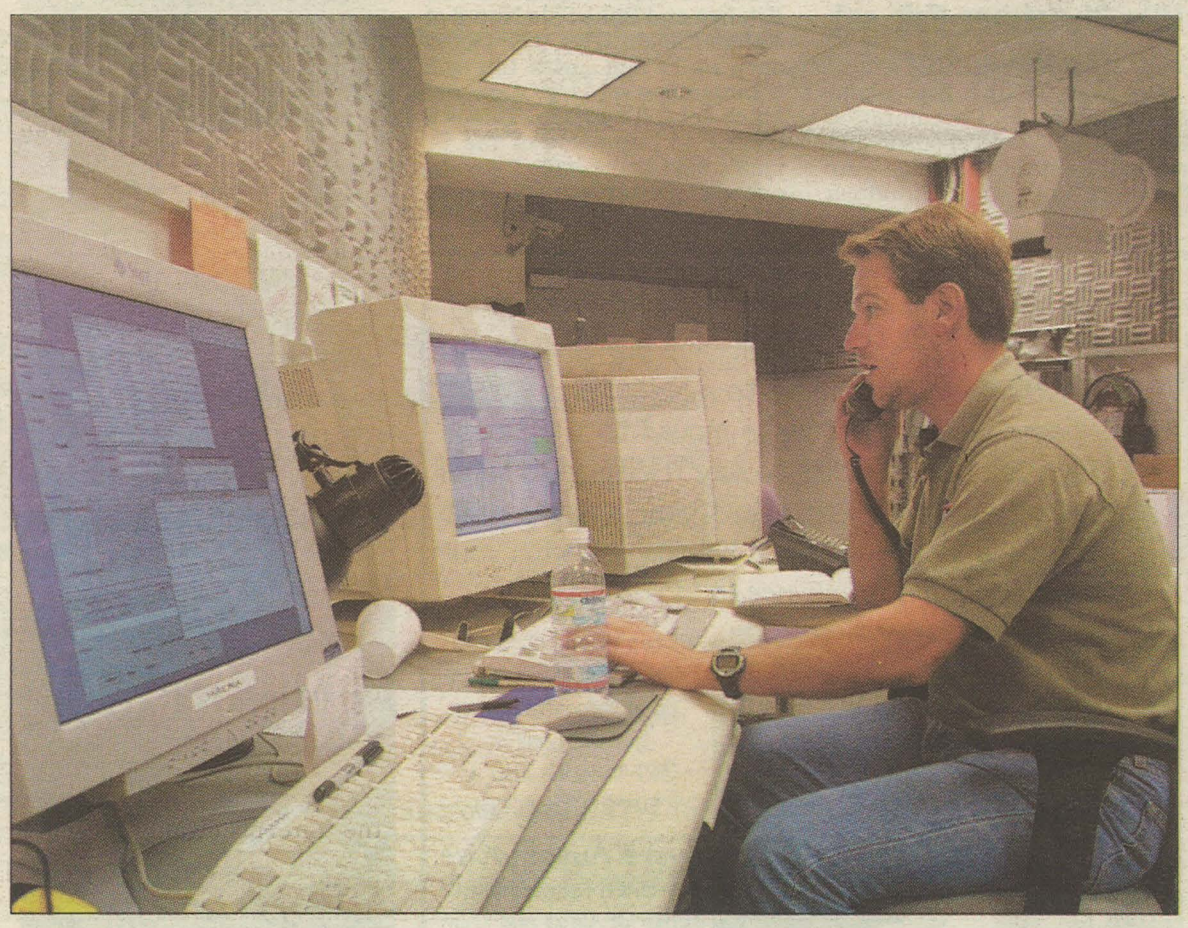
This produces detailed images with very, very high resolution though the details perceived cover an extremely small field of view.

An observation of a different sort on the summit of Mauna Kea, and as important as anything else in Keck's mission is the extreme sensitivity to environmental and cultural concerns; these are high priorities in Keck's agenda (NASA will fund four of the outriggers; Keck is seeking permits for two more, and it probable that these will be funded by a collegial investor as well.).

Asked if there was any chance that the permits would be denied, Beletic said "Possibly; we're crossing our fingers."

The permit process will be influenced by environmental and cultural concerns: "We're trying very hard to achieve a balance between everyone's needs and wishes." That they find this is critical: both Chaffee and Beletic became unusually animated when this issue was brought up, and one had the strong impression - the conviction- that they were absolutely sincere. They want to do their work, but they don't want to compromise anyone's kuliana. Their excitement concerning the science itself was equaled by their concern for the Big Island community.

OK, final wacky question: that angels can dance on the head of a pin is well-known - but what kind of dance do they do? Foxtrot? Mashed potatoes? The twist? Hey - with infinite space and everlasting eternity, anything is possible. Maybe.



MICHAEL DARDEN / NORTH HAWAII NEWS

From the Keck interferometer control station on the summit of Mauna Kea, Gerard van Belle (left) relays commands to the computers that control the alignment hardware. Team members (right photo, l. to r.) Mark Colavita, Peter Wizinowich and van Belle stand on Mauna Kea with the Keck telescopes in the background.