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Interview: Garth Illingworth

Telescope's malfunction is a setback to science

Garth D. Illingworth, of the Lick Observatory and the Board of Studies in Astronomy and Astrophysics, University of California at Santa Cruz, is co-chairman of the Science Steering Committee overseeing the instrumentation for the Keck Telescope. He is also working on the design of possible successors to the Hubble in Earth orbit and on the Moon. He was interviewed by David Cherry on July 2.

Q: Once someone specifies the curvature of a telescope mirror in a form that the mirror maker can use, does someone else typically check those figures?

Illingworth: It depends on the system, but typically, yes. You would have somebody who would do an optical design, and from that you would come up with the requirements for the mirrors or lenses or whatever else was in the system. For something like the Hubble mirrors, I assume that you would normally have people check that, or you would have a couple of people do the design. That would certainly be the normal procedure for something so fundamental. There would be quite a bit of discussion about the actual adopted figures and the ray-tracing itself, and the aberrations, and there would be iterations based on that.

It's a long iterative process. You do a design, and then you sit and look at the trade-offs you have made, and you talk about it, and you change some things, and you go back and you do it again. It takes some time to bring it all together and come up with a set of specifications. Usually there is a bunch of people involved in that just to make sure that nothing goes wrong.

Q: One of the hypotheses in circulation right now is that the mirror was ground to specs, but that the specs were wrong, systematically.

Illingworth: Yes, it could well be. The error is very large. So it could be that somehow or another the wrong number got in there and it was manufactured accordingly. You know, it surprises me that that could actually happen, that there weren't sufficient checks and balances in the system. It's truly amazing that it could happen, if that was the situation, that people were working against the wrong number year after year. I suppose it is a matter of finding out exactly what happened—and whose head, if any, should be on the block for that. This is something that should never happen in any system with reasonable checks and balances. Unfortunately, human errors creep into almost everything we do, and we've got to work against that and overcome them, especially in things as expensive and complicated as this.

Q: Fortunately, the telescope was planned for visitation in orbit for replacement and repair, so, even though some people in Congress and the press want to represent that everything is lost, it isn't.

Illingworth: No, it isn't. But we certainly can't rectify the mirrors themselves. All we can do is put up instruments that will compensate for the problem, and that involves some risks. We may not get things quite right, or as good as they could be. It's a *very* difficult situation to correct from. The first of the new instruments will probably be ready by 1993, and the next one won't be ready until the mid-1990s. So that is a big chunk of time.

Q: In the meantime, isn't it true that a lot of spectroscopy can be done?

Illingworth: Yes, we can. It won't be as efficient, of course, because a lot of the energy is spilling out in the wings, and we won't be able to work on problems where you really need the resolution—even a lot of the spectroscopy. People were planning on using little apertures to isolate certain regions in complex areas. You clearly can't do that anymore.

Q: Can't you shut down the aperture to use the part of the light that is well focused?

Illingworth: Yes, but say you've got two objects close together. You can use the 20% or so that is fairly well focused, from one of them, but some of the energy from the other one is mixed in as well. Draw two dots and then two big rings around them—the rings overlap. So even for a lot of the spectroscopy, this will have an impact.

It's my view that there are *very* few programs for which this is not going to have some impact in terms of efficiency. Sometimes they just won't be possible, even in the ultraviolet, until the replacement instruments go up. So it will be three, five, six years before some of the high-priority science can be done.

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