Radio to the rescue

Washington

SIMILARITY between the distorted optical images produced by the out-of-focus Hubble Space Telescope (HST) and the signals normally generated by multi-element radioastronomy telescopes will allow some parts of the HST's planned observing programme to be salvaged, astronomers said last week. Image processing techniques developed over the past decade by the National Radio Astronomical Observatory (NRAO) have proved surprisingly effective in filtering out the blurry 'haloes' that are the principal symptom of the HST's malaise.

Rick White, of the Space Telescope Science Institute in Baltimore, says that after HST's problem was announced, "we noticed right away that the fuzzy images, with a well-defined core and nasty side lobes, looked just like radioastronomy data". The HST images, produced by an optical system whose primary mirror suffers from spherical aberration, have a sharp central core surrounded by a diffuse halo of improperly focused light (see *Nature* 346, 3; 1990). This image structure is characteristic of intensity maps produced by radio interferometers, in which signals from separate radiotelescopes are combined to produce an image whose resolution is much higher than that of the individual instruments.

Because the aberration in the HST's mirror is symmetrical and well characterized, the halo of unfocused light around each stellar image is very predictable and can be mathematically subtracted, says White. Although the size and shape of the halo are somewhat frequency-dependent, filters can be used to produce monochromatic images suitable for computer processing.

Photographs released last week by the National Aeronautics and Space Administration (NASA) show how image processing resolves individual stars within the star cluster R136, part of the 30 Doradus nebula (see below). The upper image was made with the Wide Field/Planetary Camera on 3 August; the unprocessed enlargement at lower right shows about 60 stars, more than can be seen from the ground, but in the image at lower left, enhanced using computer codes derived from the NRAO algorithms, hundreds of stars stand out. Beyond its technical significance, this image represents a genuine scientific achievement — the measured density of this cluster of young, massive stars is higher than anything previously seen.

Although image processing will restore much of the HST's full resolution, according to White, the dynamic range (the ability to detect faint objects when they are close to bright ones) cannot be so easily restored. In HST's blurred images, only 15 per cent of the total light is in a central core, rather than the 70 per cent that a perfect mirror would have provided. The rest of the light spills over into the halo, swamping any nearby faint sources. What that means, says White, is "that there's a fundamental limit to how much you can improve the image. No image-processing technique is going to put something in the data that isn't there". Similarly, the reduction in the brightness of the central core means that the HST is in absolute terms less sensitive than it should have been. Until it is fitted with a corrective lens in perhaps three years' time, the telescope will be about a factor of 10 less farsighted; the very faint galaxies and quasars that were to have been the

HST's most distant goal will remain hidden until then. Nevertheless, if observation periods are extended and the new image-processing techniques used, White thinks that as much as 80 per cent of the science planned for the HST's first two years appears to be back within reach.

Christopher Anderson

■ A statement released last week by Lew Allen, chairman of the HST Board of Investigation, confirmed that the entire half-wavelength error in the primary mirror's shape could be attributed to a 1.3-mm positional error in one of the components of the reflective null corrector (see *Nature* 346, 599; 1990).

Tantalizingly, Allen observes that some of the spacing washers in the null corrector have a thickness of 50 thousandths of an inch — or 1.3 mm. A misplaced washer may turn out to be the ten-cent cause of a billion-dollar mistake. **D.L.**

LARGEST TELESCOPE

Go-ahead for Japanese telescope?

Tokyo

JAPAN'S Ministry of Education, Science and Culture (MESC) has at last decided to start building the world's largest telescope, according to a leak in the Japanese press on Monday.

Plans for the 7.5-metre single-mirror telescope, to be built in Hawaii, have been in the works for years (see *Nature* 311, 5; 1984), and this fiscal year MESC acquired 13 million yen (\$90,000) in 'preparatory' funds for the project. But MESC officials have insisted that a final go-ahead for the project, which is eventually expected to cost 45,000 million yen (\$300 million), has not yet been given (*Nature* 343, 295; 1990).

According to a report in the Yomiuri newspaper on Monday, MESC will apply at the end of this month for 600 million yen (\$4 million) to begin construction of the telescope in fiscal 1991.

Keiichi Kodaira of the National Astronomical Observatory, a well known promoter of the project, could not confirm the Yomiuri report on Monday. He says a final decision is expected on August 22 or 23 and will be officially announced at the beginning of September. But he says he has the impression MESC is "very positive".

The telescope has competition within MESC from another large project in the form of Superkamiokande, a proposal from Tokyo University for the world's largest observatory for neutrinos and proton decay (*Nature* 331, 379; 1988). Supporters of that project are also fairly confident of winning MESC funds to commence construction next year, but they too are waiting for an official announcement at the end of this month.

David Swinbanks

Radioastronomy techniques succeeded in teasing out the information from Hubble's original effort. The merits of a partially functioning Hubble are the subject of a letter in the Correspondence pages.