Tenerife which would fall in such a category. We probably haven't yet gone very far in really adopting for the infrared some of the most recent techniques of the visible region for size measurements.

J.C. Dainty: My brief is to say a few words about the *problems* in speckle interferometry, but I feel that first of all I should point out some of the *merits* of the technique. For observations on simple objects such as binary stars using single dish telescopes, there is absolutely no doubt that speckle interferometry is a worthwhile technique; I think that's amply illustrated by the work of McAlister and others, who between them have taken thousands of accurate measurements on binary stars. The second favourable comment I'd like to make about speckle interferometry is that it is inherently capable of observing very faint objects, in contrast to some other techniques; we are still waiting for technology to realize the predicted limiting magnitudes, but I'm sure that these will be attained in the next few years.

But what are the problems? I think that these can be grouped into three areas. First of all, can you accurately decalibrate the atmosphere in speckle? I've always been very sceptical that this is possible, but at this meeting we've had several contributions which appear to indicate that yes, you can accurately decalibrate the atmosphere; measurements by the Avco group, Roddier et al and Selby and Wade (in the infra-red) all support this conclusion. And perhaps Worden's cross-correlation technique can also help us obtain accurate, seeing - independent measurements. Thus speckle might give *accurate* results on *faint* objects and be superior to "small telescope" interferometry on both counts.

Phase retrieval is another problem. I suppose it's pie in the sky for long base line interferometry at the moment - we would be quite happy to have accurate measurements of $|\Gamma|^2$ - so I'll restrict my comments to single dish interferometry There are two fundamentally different interferometric techniques that are being used to obtain images: one is the pupil plane (amplitude) interferometry of Breckinridge, Currie or Roddier and the other is the image plane (speckle) interferometry as suggested by Labeyrie and modified by Lynds et al, Knox and Thompson, Nisenson et al, and others. Which is "better" - pupil plane or image plane?

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Finally, and probably of most relevance for this meeting, what is the "best" technique of long-baseline interferometry in the visible region? I would like to suggest that there are *three* classes of long-baseline interferometers:

i) Small aperture Michelson, in which wavefront tilts are actively controlled,

ii) large aperture pupil plane (Michelson) as proposed by Dr. Currie and others,

iii) large aperture image plane (speckle) as being undertaken currently by Dr. Labeyrie and his colleagues.

Professor Hanbury Brown suggested that the main advantage of the small aperture Michelson was its *accuracy*. A large collector technique must surely give you a fainter limiting magnitude (for equal optical bandwidths) - but can it *also* give you good accuracy? The speckle decalibration results appear to suggest that this is so. So which technique is "best"?

DISCUSSION

R.Q. Twiss: There seems to be a fundamental difference of opinion as to just how important the effects of atmospheric turbulence are for very long baselines. I would say that for practical purposes at baselines of several hundreds of meters the bandwidth set by turbulence will be 2.5×10^{11} Hz. On conventional Kolmogorov theory, you expect path fluctuations of the order of 10^{-6} of the baseline, but that is undoubtedly too high, because the large scale turbulence is overestimated. There is a lot of evidence in radio astronomy which would imply that maybe you aren't as badly off as that, but you are getting very considerable differential path lengths at baselines of up to kilometers and beyond. This is a very important point.

D.L. Fried: I think you are right. The Kolmogorov theory - and the outer scale - may be misleading here. I have tried to indicate some of that in my papers. If you simply assume the Kolmogorov theory then you come up with the conclusion that you must restrict the fractional spectral bandwidth to something of the order of r_o/D. But then when you start going to large baselines, you start

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