XIV

CONCLUDING REMARKS

https://doi.org/10.1017/S025292110002251X Published online by Cambridge University Press

The Future Utilisation of Schmidt Telescopes
ASP Conference Series, Vol. 84, 1995
J. M. Chapman, R. D. Cannon, S. J. Harrison and B. Hidayat (eds)

Conference Summary

Russell D. Cannon
Anglo-Australian Observatory, PO Box 296, Epping, NSW 2121

At the conclusion of the meeting, Karel van der Hucht and Martin McCarthy SJ shared the task of giving a comprehensive summary of all the papers presented. I thank them for making their extensive notes available to me. There were also a number of lively discussions on specific topics during the course of the week. Here I will attempt to set out the main conclusions that can be drawn from the papers and discussions, and to see the way forward for Schmidt telescope astronomy. Much of the following is based on the results of a questionnaire which was circulated by the Scientific Organising Committee towards the end of the meeting, with 28 responses received.

The first three questions of the questionnaire asked which projects people had recently completed, what they proposed to do over the next few years, and which Schmidt telescopes they would use. The replies covered the full range of projects described in the scientific contributions to the Colloquium, using more than a dozen different telescopes. There seems little point in trying to summarise or even list all of these; what is obvious is that Schmidt telescopes are still extremely useful and are involved in almost every aspect of modern astronomy. I hope that many astronomers will get new ideas from seeing so many possibilities, and that those responsible for managing and funding the telescopes will realise what valuable instruments they still are.

Questions four and five probed the use of archival material and measuring machines. About a third of the projects depended only on new data while most needed a mixture of new and old, with a 50/50 split on average. This serves to emphasise the point made by Tsvetkov et al., that there is a need for an international database listing Schmidt plate archives and for making the data easily accessible to astronomers. Almost all of the respondents who use photography, about two thirds of the total, also require access to measuring machines. The great majority of Schmidt projects need digitised data, either to generate quantitative results or to cope with the vast numbers of objects recorded on each exposure. It is clear that the several very fast automatic measuring machines now in use around the world enable new types of astronomy to be done. Techniques such as plate addition and the analysis of long time-series of exposures have only just begun to be exploited, while precise astrometric and multi-colour photometric data are still available for only a fraction of the objects on sky limited exposures.

Perhaps the single most important result was the demonstration of how much can be achieved by mounting CCD detectors in Schmidt telescopes; indeed it probably came as a surprise to some to discover that at least eight such

systems are in routine use around the world, demonstrating the extent to which photography has already been superseded. About a quarter of the questionnaire respondents now require CCD data only, while another quarter want a mix of CCD and photographic data. CCDs have proved particularly effective in medium-size Schmidts, including some on excellent sites and some on poorer sites. Clearly the advantages of CCDs in sensitivity, in ease of use and in generating calibrated digitised data, greatly outweigh their disadvantages of small format and large pixels, at least for many purposes. The high cost and limited availability of photographic materials are hastening the changeover. New CCDs, with ever larger surface areas and pixels small enough to fully sample the images, are appearing; arrays of CCDs are being put in Schmidts and it is already possible to tile a substantial fraction of the full field of a large Schmidt with CCDs, as for example at Kiso in Japan. The Kiso group has also pioneered the use of an infrared array detector, described here by Ichikawa et al.

It is interesting that the tabular data given here by Parker to support photography can just as well be used to make the case for CCDs, while Peterson's figures promoting CCDs can be used to justify photography. This must mean that the argument is fairly evenly balanced at the moment; which is the better detector depends very much on the scientific programme, and to a lesser extent on the properties of each Schmidt telescope. Today, the situations where photography still wins are when the full coverage of many square degrees of sky are important, or where high resolution is needed. This generally means in the largest Schmidts on the best sites, and then only in combination with high speed plate digitisation machines. Thus for limiting magnitude surveys or objective prism work, Kodak Tech Pan film, with its very fine grain and high detector quantum efficiency of around ten percent, has extended the era of astronomical photography. On the other hand, for the surface photometry of individual relatively nearby galaxies or monitoring of uncrowded variable stars, and for working in the near infrared, CCDs are clearly now the better choice.

The conclusion which can be drawn from this is that if you have an underutilised Schmidt, especially on a mediocre site, then you should probably abandon photography and equip it with a CCD. Even a small CCD will give a new lease of life and open up many important astronomical opportunities. For a few large Schmidts on good sites it is important to maintain photography for those survey projects which cannot yet be done as effectively in any other way.

Question seven asked about any special instrumentation, such as the use of optical fibres for multi-object spectroscopy. The most widely used system is FLAIR at the UK Schmidt in Australia, with a few similar systems being developed elsewhere. Judging by the strong international interest in FLAIR, there is probably scope for other Schmidts to be equipped with fibres.

The final point on the questionnaire asked for views on the best future uses of Schmidt telescopes. For the smaller Schmidts, two thirds of respondents opted for the use of CCDs, particularly for monitoring programmes and for accurate photometry, either of individual objects or to calibrate photographic data. Several mentioned searches for asteroids and other solar system objects. For the large Schmidts, the most popular programmes were deep selected area surveys, mostly using Tech Pan film, and proper motion surveys over 20–30 year baselines in various wavebands. One specific possibility is the use of interference filters with Tech Pan film for an Hα survey of the Milky Way. On the technical side,

the implementation of large arrays of CCDs was seen as the top priority. Earlier there had been much discussion about astrometry with Schmidt Telescopes. Clearly, the internal precision is at the level of one or two tenths of an arcsecond, but achieving sub-arcsecond absolute accuracy over fields covering several degrees has proved much more difficult. Most of the problems now appear to have been solved and Schmidts have a key role to play in tying together different reference frames, and in providing target lists for multi-object systems on larger telescopes.

As well as debating scientific and technical issues, a parallel objective of the colloquium was to try to foster international collaboration. As always, probably the most important outcomes will be the new cooperative projects initiated directly as a result of meetings of individuals in Bandung, from the exchange of ideas and the formation of new friendships. But we also had some very thoughtful and thought-provoking contributions from astronomers with long experience of successful collaborations, particularly in the Asian-Pacific region. These give important guidance as to how we should go about developing larger scale programmes which can lead to the enhancement of astronomy within each country. Some countries have equipment and expertise which can be made available to astronomers from other countries, while some have enthusiastic young astronomers but a lack of facilities. For the largest projects, such as building the next generation of super telescopes, the cooperation of many countries will be necessary. At a less ambitious level, there are many bi-national cultural and scientific exchange agreements which astronomers must learn to exploit. Astronomy, being a discipline in which all people have a natural interest but which is without political or military connotations, has a key role to play in helping to develop better relations, greater tolerance and deeper understanding between nations.