Inherent Small Telescope Projects

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Abstract

As we stand on the verge of substantial access to the new generation of giant telescopes (Gemini, VLT and others) it is timely to consider the range of science that can be undertaken with the substantial number of smaller telescopes that are spread around the globe. While providing survey science input to the giant telescopes, or simultaneous monitoring capability for space missions, is a clearly important role (see previous contributions), it should not be forgotten that there are still many outstanding scientific programmes that *can* be undertaken on smaller telescopes in their own right. There is a danger of these opportunities being overlooked in the stamped to abandon the smaller telescope "baggage" in the hope of acquiring access to more giant telescope time. I will try to demonstrate that the most effective and efficient use of *all* our telescope time requires access to a broad range of complementary facilities. I will therefore describe here some of the projects currently being undertaken with smaller telescopes as well as some of those planned for future facilities such as ROBONET.

Key words: Small telescopes; ROBONET

1 Introduction

The substantial UK involvement in the Gemini Project (Roche, 2000, these proceedings) is a result of the natural evolution of our ground-based optical/IR facilities over the last two decades. From the AAO and UKIRT in the 1970s to the development of ING in the 1980s the UK took the lead in acquiring all-sky access with a range of telescopes in the 1–4m class. These facilities have been the work-horses for UK astronomers, enabling us to reach world-class standards in many fields. However, with the advent of giant telescopes (first Keck, now the VLT) the role of sub-8m telescopes is being reviewed. Roche has described the important part they play in providing preparatory observations for Gemini programmes, and Charles & Mason (2000, these proceedings) have emphasised their significance for supporting space-based observations at other wavelengths. This is likely to lead to observing time on sub-8m telescopes being allocated in strategic or project-targetted ways compared to the present.

However, there is a danger in this process of the science that can be accomplished with small telescopes *alone* being overlooked. I believe that this is potentially a serious problem as there are many examples of front-rank science that small telescopes can perform perfectly adequately. We must not fall into the trap of *defining* front-rank science as that achievable only with giant telescopes! Indeed there is much excellent science currently being performed on small telescopes that would be almost impossible to get time for if all their time was concentrated on support work of one kind or another.

Continued access to sub-8m telescopes is extremely important for a number of reasons:

- ability to try out innovative ideas which might be considered too speculative by time assignment committees. Large telescope time allocation committees (TAC) can often look for more "guaranteed" results that discourage novel concepts from being investigated. (Service time is supposed to provide such opportunities, but it too is heavily oversubscribed on our most powerful facilities.)
- access to longer blocks of observing time (often in units of weeks) so that surveys of brighter objects can be undertaken. This has the great advantage for the giant telescopes in freeing them up for targets and science that can *only* be performed on them! Indeed it is expected that giant telescope TACs will require proposers to show that their programmes cannot be undertaken with smaller telescopes (in much the same way that HST time is only allocated for observations where all possible ground-based options have been fully explored and exhausted). It is certainly unlikely for observers to acquire weeks of time on Gemini!
- the stability of instrumentation suites on smaller telescopes (often substantially restricted) allows long-term and monitoring programmes to be undertaken that would be virtually impossible (both due to total time needed and instrumentation restrictions) on giant telescopes. (However, it is possible that Q-scheduling will make certain long-term projects feasible.)

2 Range of Small Telescope Science

It would obviously be impossible to survey fully the range of science undertaken on ING in this review. That it is healthy in volume is demonstrated by the publications output over its 15 years of operation (Fig 1). Note that the INT and JKT reached a mature steady output a few years after startup, but the WHT's output continues to grow! I have concentrated instead on recent (the

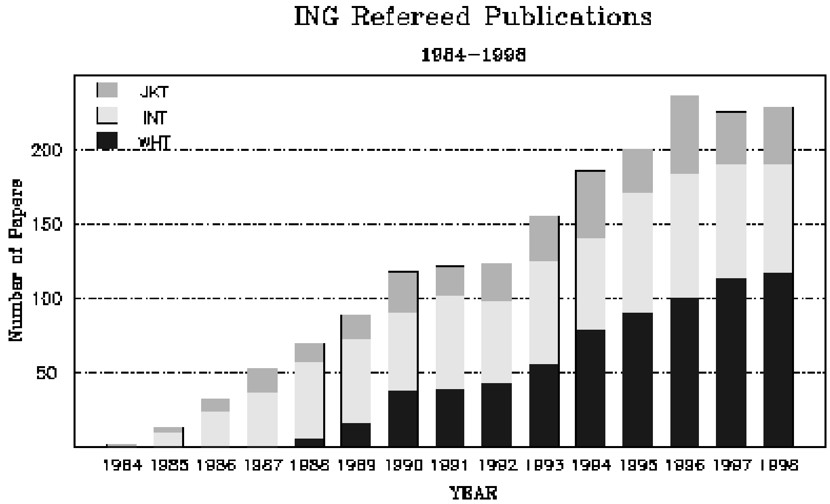

Fig. 1. *Refereed publications associated with each of the ING telescopes since their inception. Note that output from the WHT continues to increase, more than 10 years after it started operations.*

last year or so) results from smaller telescopes (mostly ING, but also including results from SAAO and the superbly successful MACHO monitoring of the LMC and galactic bulge region; Alcock et al. 1995), with a selection that indicates the wide range of science currently being undertaken, and where this work is *independent* of space observations or other large telescopes. Rather than attempt to précis all these results here, I have itemised them together with appropriate references in Table 1.

3 ROBONET

It seems appropriate to end with a brief description of an exciting new ground-based astronomy project that would revolutionize time-domain astrophysics, and yet uses small telescopes with entirely proven technology. Steele (2000, these proceedings) has already described the 2-m Liverpool Robotic Telescope that is due to start operations on La Palma in late 2000, and a consortium of UK universities led by St Andrews (K. Horne[1]) has prepared a proposal to produce a network of such telescopes around the globe which we have named ROBONET. This would provide all-sky 24-hour coverage for both very fast phenomena (response to γ-ray bursters within seconds) and very long

[1] http://star-www.st-and.ac.uk/ kdh1/jifpage.html

Table 1
A selection of small telescope science programmes 1997-8

Project	*Reference*
Stromgren stellar photometry	Mooney et al. 2000
Cool companions to sdB stars	Jeffery & Pollacco 1998
Post common-envelope binaries	Wood et al. 1999; Wood & Saffer 1999
Monitoring of Be systems	Stevens et al. 1997; Steele et al 1999
Radial velocity study of Cyg X-1	Lasala et al. 1998
"Inside-out" outburst of IP Peg	Webb et al. 1999
Pulsating white dwarf in a CV	van Zyl & Warner 2000
Supersoft sources in the LMC	Southwell et al. 1996
Period-Mass distribution in double-degenerate binaries	Maxted & Marsh 1999
Mass of Milky Way halo from blue HB stars	Warren et al. 2000
Inter-arm and circum-nuclear star formation	Perez-Ramirez & Knapen 2000

timescale monitoring (weeks to months to years), both of which are essentially impossible on current facilities. ROBONET also holds out the tantalising prospect of being the only feasible ground-based method by which earth-sized planets could be detected around other stars (utilising gravitational microlensing). Note that this cannot be undertaken with individual 8-10m class telescopes.

While ROBONET was not funded by JIF, further copies of the Liverpool Telescope are being produced through private funding for educational and public understanding of science work. It therefore seems inevitable that ROBONET will come into existence within the next decade and provide the perfect exploitation of the now relatively inexpensive 2m-class telescopes combined with advances in reliable computer control and scheduling, and ease of access over the Internet.

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