Observations – Concluding Remarks

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I must speak for all the professional astronomers here in saying that I am most impressed by the contributions made at this IAU Colloquium by amateur astronomers. I spoke earlier of the contacts between amateur astronomers and the IAU Central Bureau for Astronomical Telegrams and Minor Planet Center, particularly with regard to discoveries of comets, novae, supernovae and minor planets. But I also spoke of the great importance of follow-up observations and computations. Janet Mattei has quoted Fran Cordoba's remark that "discoveries belong to those who keep vigil on them". It is difficult to deny that the routine of follow-up lacks the glamor associated with making a spectacular discovery, but such discoveries are few and far between, and we need to give greater credit to the unsung heroes who go steadily about this work. Even if all the professional astronomers in the world wanted to pursue this routine, there would not be enough of them to monitor everything that needs to be watched. This is precisely where the amateur comes in.

Although observational work by amateur astronomers is nowadays conducted in a variety of ways, the predominant mode of observation is still by the traditional use of telescopes visually. Visual work discussed at the conference involves (a) discoveries (of comets, novae, supernovae and other variable stars); (b) magnitude estimates (of the same objects); (c) observations of Jupiter's satellite phenomena (including mutual events); (d) identifications of double stars (for HIPPARCOS); (e) counts of sunspots; (f) micrometric measurements of sunspots and studies of sunspot motions; (g) inspection of transient features on the planets); and (h) naked-eye observations of meteors (for the identification of new showers and the evolution of established ones).

Photographic work conducted by amateurs concerns (a) discoveries (also now of minor planets); (b) recoveries of comets and minor planets; (c) astrometry (of comets, minor planets and double stars, some of the minor-planet work being in connection with occultations or near occultations of stars); (d) investigations of cometary features (near-nucleus activity, tail disconnection events); (e) observations of sunspots; (f) measurements of isophotes at solar eclipses; (g) double-station detections of meteors; and (h) observations of deep-sky features such as galactic bridges.

Photoelectric observations are becoming increasingly popular with amateurs, principally of course for photometry of variable stars, but some amateurs are also doing work in polarimetry.

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Spectroscopic work by amateurs tends to need a good strong light source, so it is reasonable that much of it should involve studies of the sun in H-α light or the measurement of radial velocities in solar flares. Nevertheless, we have also heard of stellar slitless spectroscopy down to magnitude 10–11. Spectroscopy is clearly an area worthy of further attention by amateurs in the future, particularly as it pertains to transient or otherwise variable celestial objects.

The astronomical use of video is relatively new, but amateurs have been quick to adopt it. Video is used most extensively in occultation work, but it also plays a role in the study of solar eclipses (including observations of Baily's beads and measurements of the solar radius). It has also been used to detect the rotation of artificial satellites and in scintillation studies.

Other observational activity by amateurs has included CCD imaging of galaxies, balloon detections of micrometeors, and radio observations of meteors and the sun.

Amateurs are also very much involved with astronomical computing, and since much of this computing is closely related to observation, it is appropriate to mention it here. Orbit computation is a topic to which amateurs make particularly useful contributions. This applies to comets and minor planets, and also to double stars. There are also extensive analyses of lightcurves of variable stars and comets, with results ranging from determining parameters of eclipsing-binary systems to examining problems of thermal equilibrium. Amateurs are concerned with computerized databases and have investigated the cometary dust production required to match observed cometary dust tails.

Most of the above research is conducted by amateur astronomers using their own equipment. Impressive work is also done by amateurs using professional equipment, sometimes – but not always – in collaboration with professional astronomers. Amateurs use professional equipment most notably at Pic du Midi (a 60-cm reflector and a 50-cm refractor), but also at Strasbourg and Meudon. Mention can also be made of the proposed involvement of amateurs in programs to be conducted with the Hubble Space Telescope. In addition to telescopes, measuring engines are items of professional equipment that can be and have been particularly utilized by amateurs.

Ennio Poretti remarked that professional astronomers must drop their prejudice against amateurs. At the same time, however, it is necessary for amateurs to demonstrate the reliability of their work. Specifically, Zdenek Kviz pointed out that amateurs should be sure to give enough information so that future researchers can assess this reliability. As an example of the kind of problem that can occur, let me mention the episode of the Aries (or Perseus) flasher. The amateur astronomer principally involved in this episode first telephoned me about these strange observations toward the end of 1984. The only opportunity I was given to assess his reliability was his own statement that he was the leading amateur meteor observer in his country. I refused to publish the observations in the IAU Circulars. A few months afterward I was startled to see them mentioned in Sky and Telescope. Later I was later absolutely appalled to see them discussed at length in a paper in the Astrophysical Journal Letters. This paper, written with several collaborators, some of them professional astronomers, had been subjected to the normal refereeing process of this professional publication, and it was finally accepted on the grounds that the

editor did not want to be accused of rejecting an intriguing result just in case in might conceivably be valid. But it was obvious to numerous astronomers, amateur and professional, that the data being discussed were most unsatisfactory. Not only did the authors not demonstrate their reliability, but the bias of the professional editor toward amateurs took the very worst form – that of patronization.

I have occasionally been accused of an anti-amateur bias, in that I have not accepted results submitted by amateurs for publication in the IAU Circulars or Minor Planet Circulars. This is unjust: professional results have been rejected too, and I have merely insisted that reports by amateurs and professionals meet the same standards. One of the amateur astronomers whose work I have rejected has complained that he is "only an amateur and does not have access to the facilities and the knowledge of professionals". This is not an acceptable excuse. If an amateur expects recognition in an area of astronomy that is also practised by professionals, he must play by the same rules. In responding to the Aries flasher paper in the *Ap. J. Lett.*, Paul Maley, an amateur astronomer with a great deal of experience, demonstrated that the principal evidence put forward concerning the flasher – a single photograph – was in all probability the observation of a glint from the artificial satellite Cosmos 1400. Maley is an amateur, but his demonstration was conducted in a completely professional manner.

So, when it comes to discussing specific astronomical observations, let us not distinguish between amateur and professional. If we are to make any distinctions, they should surely be only on the grounds of competence.

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