

SOME THOUGHTS ON ASTRONOMICAL DATA FILES

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Several astronomers were relaxing after a hard day at the I.A.U. when the talk got around to their research activities. One said, "There is a red star found in the Lowell proper-motion survey that seems rather interesting - it is G232-75, which has a proper motion of almost a second of arc per year. Since Giclas' catalogue doesn't give any spectral type I'm planning to go to Kitt Peak to observe it. The trip only costs about 300 dollars, and besides it's fun to visit Arizona."

Second astronomer (a photometrist): "Don't bother; UBV photometry is published for this object in Johnson and Morgan's classic paper (Ap. J. 117, 313, 1953). This will tell you all you need to know. I suppose maybe they give a spectral type for it too but I usually don't pay any attention to those."

Third astronomer (a spectroscopist): "I take umbrage at that remark. Actually, Giclas identifies the star as BD +56°2783. With some effort you will find that it is not in the Henry Draper Catalogue, but if you are clever you will find that it is in the Henry Draper Extension, and assigned type M. However, Johnson and Morgan call the object dM4 + dM6, thus implying that the star is double. The types are indicated as being due to Kuiper, but where he got them is beyond me. Also they refer to the star as Kr 60, which I suppose means Kuiper 60, though I'm not up on all of these oddball designations."

Fourth astronomer (a binary chap): "Really, now, everybody knows that Kr 60 means Krüger 60, not Kuiper 60! Since the star is obviously close to the sun, you should have looked it up in Kuiper's famous (Ap. J. 95, 201, 1942) paper on the nearest stars.

Joy and Abt (Ap. J. Suppl. 28, 1, 1974) give newer types of dM3.5 and dM4.5e, which may or may not be better. The binary has an orbital period of about 44 years. The only thing I don't know is who this joker named Krüger was. I looked him up in the American Astronomical Society membership list and he wasn't there. Maybe he didn't pay his dues."

Fifth astronomer (an older man): "Nonsense! If you were more scholarly you would know that Adalbert Krueger was the director of the Kiel Observatory from 1880 till 1895 and also editor of 40 volumes of the *Astronomische Nachrichten*. In his younger days he worked on the Helsingfors-Gotha $+55^{\circ}$ - $+65^{\circ}$ zone of the *Astronomische Gesellschaft* catalogue and in the footnotes to that work he listed some new double stars that were found with the meridian circle. But strictly speaking he doesn't deserve to have his name attached to the stars that you are talking about; the pair that he discovered was a rapidly-separating optical pair of no interest whatever. What really happened was that Burnham, at Lick, decided to look at all of Krueger's new doubles, and in doing so he found that the primary of Kr 60 was itself a 2" double. The "60" designation comes from the fact that this star was the sixtieth object in the list of new doubles that Burnham made up from the A.G. catalogue. Krueger never published such a list at all!"

Sixth astronomer (obviously very bored): "You guys are all missing the point. The only thing of real importance about this binary is the fact that the fainter component is a flare star called DO Cephei."

Seventh astronomer (who has just awakened from his slumbers at the mention of the words "flare star"): "Say, fellows, if there's any chance that your star is an X-ray source we'll fly a special satellite just for it. Uh, by the way, would you mind telling me where it is? You know I've got a terrible sense of direction."

(the end)

It is clear from my tale that one cannot get the full story on any astronomical object merely from its presence in any specialized catalogue; one needs also bibliographical information on the sources of data and on the uses that have been made of it.

My main concern today, however, is not the desirability of a general bibliographic astronomical data file, or even the details concerning its establishment or use - it is the necessity of making the data contained in the file as accurate as possible. This means, of course, as accurate as humanly possible, and I want to stress the fact that the intervention of human intelligence is essential if we are to propagate truth, not error. Now of course

we all know that published astronomical data are extremely inhomogeneous in quality, to put it mildly, and appropriate account of this fact should be taken by the conscientious data compiler. But here I am not so much thinking of this as of the numerous typographical or other more significant errors, such as erroneous or dubious nomenclature, magnitudes, spectral types, coordinates, etc. that all too often occur in the literature. All of us who compile astronomical data can recite hair-raising stories of bloopers that have long gone undetected. We owe it to our successors not to perpetuate this sort of thing.

I suppose that the ultimate blame for typographical errors can be laid on the shoulders of the inventor of printing, who I understand spent some time in this city. The best thing about a lead pencil is the eraser at the other end, and the worst thing about printing is that corrections have to be made later. And today, when we are likely to introduce further errors into data compilations through card punching and other computer operations, we are in the unfortunate position of being able to propagate errors faster than ever before.

Anyone who has seen any amount of wordage through the press has experienced the most annoying kind of typographical errors - those for which he himself is not responsible. Editorial offices can do strange things over which we have little or no control. I recall a few amusing instances of this sort of thing. As you probably know, the headings at the tops of the right-hand pages or articles are usually supplied by the editors. On one occasion Sahade and Struve (Ap. J. 126, 87, '57) were surprised to learn that they had written an article on W. (sic) Serpentis rather than on the variable star W Serpentis. Presumably the W. was an abbreviation for the star's first name. And Anders Reiz (Ap. J. 120, 342, 1954) was amused to see that his article involved "Stars with Negligible Content," rather than, as intended, "Stars with Negligible Content of Heavy Elements." George Herbig was a similar victim when he was quoted in IAU Vol. 8, p. 807, 1952 as saying, in the case of the variable star BE Cas, that "a companion about 25 inches distant in p.a. 260° is of spectral type G." And finally, a delightful blooper implying a non-existent author is to be found in the recent Monthly Notices 169, 7p, 1974 in which an article on stellar polarimetry is attributed to V. George and S. J. Coyne rather than to George V. Coyne, S.J. This got as far as A. and A. abstracts!

This sort of thing, of course, doesn't hurt anything, but unfortunately editors and printers also like to take liberties with figures and figure legends. It is not unknown for diagrams to be gratuitously interchanged. If one is extremely unlucky his photographs can be turned upside down or half of his article deleted. Sometimes, of course, this can improve the paper.

Then there are the sorts of misprints that are apt to be one's own fault: I once (Ap. J. 113, 304, 1951) accidentally classified a G8 V star as B8 V; luckily no one read the paper, so my reputation did not suffer unduly. It is quite common to find transposed digits or interchanged lines or columns in tables, to say nothing of references that do not refer to what they are supposed to refer to. Some authors are more prone to this sort of thing than others, of course. Many such errors are easy to spot and can quickly be rectified by a knowledgeable reader, but in some cases it is not easy to decide whether the questionable datum is a misprint or is just plain wrong. Only the author knows for sure, and he may be dead or otherwise unavailable.

Some who peruse the literature with a critical eye may find the pursuit of faux pas a pleasurable diversion, but to others errors in published work are deadly serious. I have recently had occasion to regret that the Smithsonian Astronomical Observatory catalogue occasionally fails to add the little "a" that should follow some BD numbers (e.g. +59°2664). This is how you can end up with two different stars with apparently the same BD number. Also I recently found (IAU Var. Star Bull. No. 1138) that two innocent stars have been wrongly suspected of being variable for 70 years simply because of minor designation errors in an AAS meeting abstract. Unfortunately in the bulletin in which I reported this, the word abstract is misspelled!

Even such a fine work as the third edition of the Yale Catalogue of Bright Stars has a few errors--though very few for such a large job. Most of us are aware of the difficulties that computers have with such numbers as $-0^{\circ} 25'$, and thus know about the errors in sign of some of the galactic latitudes in this catalogue. But you may not be aware that the star HR 3104 is assigned a declination of $+46^{\circ} 76'$, which is enough to give one pause, whereas its true declination is actually some 30° different. Also, do not bother to look up HR 365, as it is not there. You will find it in the 1940 edition. Another cautionary word: don't use the Bright Star Catalogue as a source for the apparent magnitude of Arcturus. The sign is wrong!

There are even stranger things in the literature. I have some recollection of tabulated right ascensions off by several hours of time, as well as considerable confusion between BD, AG, and Bergedorf numbers, X's and chis, between capital A's, small a's, and alphas, and zetas and xis.

There is a predictably great amount of trouble with stellar coordinates due to precession, which is certainly one of the astronomical phenomena that we could usefully do without. Coordinates are not infrequently half-heartedly precessed, or, even worse, attributed to erroneous or even unspecified equinoxes.

Some of the confusion in the literature can be cleared up only by recourse to new observations. My colleague Bruce Stephenson has recently published two general catalogues of carbon and S-type stars, in the Warner and Swasey Observatory publication series, and I paraphrase here his remarks concerning the S star EP Vulpeculae: EP Vul, then nameless, was first recognized as an S star by Rust. The star has often been referred to as CE Vul, but the identification charts for the two stars plus Case and Hamburg objective-prism plates make it clear that the only S star in the region is EP Vul. Schaifers, looking for EP Vul because it had no published spectral classification, evidently found it and misclassified it as a carbon star; and in my carbon star catalogue I rejected it as carbon and corrected it to an S, although I was not then aware that EP Vul was already published as an S star under the name of CE Vul.

Eternal vigilance must be exercised in dealing with the literature. Recently my assistant casually, and without question, put into my data file some new variables in Monoceros that were assigned declinations in the +40's. Only the fact that I knew that the unicorn did not extend to a declination of +48° prevented us from making a serious mistake. Now I hope that no one will think that I am being unduly critical or making light of the splendid work that was and is being done by yesterday's and today's cataloguers and data compilers. But my experience has taught me that indeed published data must be critically examined before being accepted at face value and put into automated form where it will be speedily and broadly disseminated to less critical users. And while there is much that machines can do, the final stages of critical examination must be done largely by the human brain rather than by automation.

A final word should be said about errata as such. One of my former colleagues at Yerkes used to complain, when especially exercised, that the Harvard Announcement Cards were the only astronomical publication that didn't run errata. He thought they should! Actually, our treatment of the erratum problem in general is not satisfactory. Some authors send them in for publication six months or a year after the appearance of their papers; some never do--like the doctors they prefer to bury their mistakes. But even published lists of errata rarely fulfill their purpose, and I believe that perhaps, along with general astronomical data center, or data centers, we need an astronomical error center as well, that would see to it that errors in published material are as well known as the original papers. In any case, whether this proposal will result in anything definite, we who are concerned with data handling should put accuracy as our highest priority; I would rather be accused of knowing too little about something than of knowing too much about it that isn't so.