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Panel discussion on 'large surveys in Galactic astronomy'

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Abstract. A summary of the topics considered in the panel discussion during Joint Discussion 13 of the 26th IAU General Assembly, Prague.

1. The discussion

In the spirit of making this meeting truly a *joint discussion*, about an hour was devoted to a general discussion of its topic, large surveys in the Galaxy and the resulting science. Written "homework", i.e., brief reflections, proposals or questions arising from the Joint Discussion (JD13), had been encouraged at the end of the previous afternoon's session. Only one participant availed herself of this aid, though the topic had clearly been in people's minds overnight.

While the rest gathered their thoughts, Julio Chanamé pointed out that wide binaries were a gold mine for Galactic astronomy (see IAU Symposium 240 in this same 26th IAU General Assembly, Prague). By analysis of the data in proper motion survey catalogues, e.g., the New Luyten Two-Tenths catalog, these binaries can be classified cleanly as belonging to either the disk or the halo. This gives information on the formation of stars in the early Galaxy, on the age of the halo, and on the nature of halo dark matter. Chris Corbally recalled an earlier remark in the JD13 that solar neighborhood observations could be very relevant to cosmology!

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Coryn Bailer-Jones posed a question to Sofia Feltzing: when looking at abundance variations, is an overall α-element abundance sufficient, or should individual magnesium, calcium, etc., abundances be included? Feltzing thought that more information could be gained from looking at individual elements, since they have different nucleosynthesis origins, but that it would be complementary to take first the overall α-element abundance and then the individual abundances.

This invoked a reminder that surveys were useful not only to find the very low metallicity stars, but also stars with high, several times solar abundances. The latter kind will be found in significant numbers as surveys sample larger and larger numbers of stars. Tom Lloyd Evans agreed that large surveys had the benefit of discovering the very rare types of stars, such as peculiar types among the high velocity stars. In this discovery, improved auto-classification tools would be most helpful.

Tim Beers followed with the conviction that when we get millions of stars in our databases, we shall gain a new level of understanding of stellar atmospheres, convective modeling, and other stellar conditions. Birgitta Nördstrom's experience was that already larger surveys give improved calibrations, which in turn mean better derived parameters for stars.

Heidi Newberg looked to the coming surveys and said that we need to work on getting better photometry, even whole-sky coverage, and deeper probing of galactic structure. Radial velocities are wanted for stars of magnitude 17 to 20, i.e., such as the Gaia survey promises. And of course we want it now, not in 15 years time! And for at least 500 million stars! There was a comment that we would need to match all these data, particularly those from radial velocities, with an adequate Galactic model, one that moved from the high level debris in the Galaxy to determining the Galactic potential. Rosie Wyse indicated that we would find help from the wide-field, multi-object spectrographs on Gemini telescopes, GMOS and FLAMINGOS-2, and also that these were problems for the LSST and for the IR multi-object spectrograph on Subaru, MOIRCS, to tackle.

Joss Bland-Hawthorn said that the critical components for models of the Galaxy were the bulge and the arms; then the rest of the Galaxy model should follow. Amina Helmi agreed. When we have data on a billion stars, Matthias Steinmetz predicted that we shall realize that the Milky Way is a dynamical, not an equilibrium system. He wondered how we were going to analyze all of these data. Bland-Hawthorn replied, "We have you," to the laughter of those present. Anthony Brown reported that an Oxford meeting had already emphasized the need to build large models of the Galaxy.

On the topic of increasing our knowledge of the Galaxy, Mike Bessell described how the SkyMapper project at Siding Spring Observatory[1] is able to fill a niche by adding a Strömgren u filter and a v_s filter, giving the survey great sensitivity to metallicities as low as [M/H]=-4. The remaining four of its filters are the same as for the Sloan survey. SkyMapper is going to 21 or 22 mag., and it has an excellent system of standards.

The next two contributions expanded the scope of the meeting. Greg Madsen spoke about paying attention to the gas dynamics within the Galaxy and to its high velocity clouds; and Jim Caswell asked if any other radio spectrum astronomers were present and doing this kind of work. Rosie Wyse agreed that radio data were really important for finding out what is going on in the outer galactic disk and that these data help in giving the full 3-D model of the Galaxy. Chris Corbally commented that a longer meeting, as originally conceived for this topic, would allow such broader input and considerations.

In the spirit of wider horizons, Tim Beers wondered how to take ourselves, who are all astronomers even if working at different wavelengths, into an expanded community of physics and chemistry and geology. This would help in tackling a large experiment, such as Galactic modeling, with the appropriate large tools.

2. In conclusion

To leave time for the concluding remarks from Tim de Zeeuw, the discussion finished there. Its main effects were to solidify concepts presented by speakers during the JD13, to broaden horizons, and to enhance the sense of common enterprise and excitement as all looked forward to exploiting the new, really large databases for research into Galactic astronomy.

[1] http://www.mso.anu.edu.au/skymapper/