CSN1 comments to the DVS

Suggestions for the overall DVS structure

It would be useful to have a look at the NAS Astro2020 report, which is structured in a first part devoted to big science themes and objectives, and then in a series of more specific appendices devoted to measurements and computations, enabling technologies and their implementation.

Many astrophysical themes are cross-RSN by nature, and the new structure of the DVS in principle could account for that. For example, one may structure the DVS into broad themes rather than rigidly dividing them among the various RSN.

Another possible suggestion is to give the document a 'flow' around the big-themes addressed, e.g. following a cosmic time sequence, or a 'spatial scale / cosmic density' sequence.

Some suggestions for the RSN1 part (but some are also more general)

- need to condensate the many questions in the current DVS to fewer key questions;

- need to update the list of surveys and instruments to be mentioned. For example, SPICA is obsolete, as well as the ALFALFA survey. Current and future HI surveys are and will be performed with Meerkat and SKA, respectively. Other instrumentation has to be stressed, e.g. LOFAR;

- stress the importance of cosmic magnetism and its evolution. Highlight that the number of physical sources where this can be studied are important probes of how magnetics fields and relativistic plasmas couple in large scale structures;

- the current cosmology section is unbalanced: the reionization, dark matter and inflation parts overwhelm the part on dark energy studies, which should instead gain more weight;

- expand on numerical studies which will likely gain more weight in the next years;

- in galaxy evolution, need to push the cosmic frontier to $z \gg 6$. Give much more weight to JWST studies of primordial galaxies and BHs. In particular, a key question not yet addressed is: what is the origin of SMBHs? Worth mentioning that early obscured AGN populations need to be searched for to understand the bulk of BH growth;

- the session on star formation can include also topics related to the study of the star formation in nearby galaxies; spatially resolved studies are relevant to understand the star formation process by itself, but also the connection with the properties of the host galaxy. SF and ISM across cosmic times can also be included to make the session more homogeneous and not restricted to RSN2;

- another example of cross-theme with RSN2 is the study of the Local Group, whose relevance as a test for cosmological models (LCDM) should be remarked, as well as the use of galaxies in the Local Group to study galaxy assembly and dynamical processes in groups;

- it would be worth emphasizing more future studies on protoclusters and their gas content (e.g. CGM);

- in current summary tables (e.g. page 96-97) 'methods' include rather different things like observational bands, physical mechanisms and cosmic sources. It is suggested to provide a cleaner separation among those;

- the current DVS suggests that INAF should get a strong participation to precursors of future programs/facilities. Thinking about Athena precursors, a broader participation to XRISM may be emphasized;

- the current DVS suggests to improve cooperation with ASI. It is worth mentioning the cooperation with other institutes, e.g. INFN, for example on GW and neutrino detectors;

- need to discuss how to exploit at best national facilities, e.g. LBT and SRT, to address the key science questions in the DVS. For example, how do we need to improve the LBT performances/instrumentation for RSN1 themes?