"ASTRONOMICAL SPECTROSCOPY & THE VIRTUAL OBSERVATORY": CONCLUDING REMARKS

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ABSTRACT

The Euro-VO Workshop "Astronomical Spectroscopy & the Virtual Observatory" has been a great success. It has provided an excellent forum for discussion between the community of data providers and scientific users, and teams involved in the development of the Virtual Observatory. The paper summarises lessons learnt and key topics.

Key words: Virtual Observatory.

1. INTRODUCTION

The origin of the "Astronomical Spectroscopy & the Virtual Observatory" workshop is in the kick-off meeting of the Euro-VO Data Centre Alliance (DCA) project in October 2006. EuroVO-DCA is a Coordination Action funded by the European Union through the last *Communication Network Development* FP6 call for proposals (Allen, 2007). It aims at coordinating the take-up of the Virtual Observatory framework by European data centres. The different project activities are allowed and encouraged to organise focused meetings on topics of interest to several of the project partners. Spectroscopy emerged immediately as a very promising theme, because several VO national projects have been working in the past years to increase the VO awareness of their community in this domain, and because the European VO teams are very active in the development of VO standards and tools for spectroscopy, in collaboration with their colleagues from other VO projects. This Workshop has been organised jointly by the Euro-VO Data Centre Alliance and by the Euro-VO Facility Centre, which is in charge of communication with the community.

The Workshop organisers have deliberately chosen to concentrate on science drivers and VO standards and tools, to avoid spending too much time on describing the VO project itself, which would not have been very relevant in the Workshop context. It is however worth giving here a few reminders about the astronomical Virtual Observatory endeavour. It is in particular important to remember that the development of the Virtual Observatory begun not so long ago, around 2001. It was understood from the beginning that *interoperability* is the key of this world-wide, disciplinary-wide project. It was thus mandatory to put mechanisms in place to develop and agree on common standards. VO teams around the world have devoted a huge amount of work to build and discuss these standards, in the national projects and at the international level. The International Virtual Observatory Alliance (IVOA) was founded in 2002 to coordinate these efforts. Several standards have been adopted a few years ago already, the first version of the remaining ones is nearly ready: now a new phase is beginning for the VO, with uptake by data providers, operations, and then usage by the science community.

We need direct contact between the VO developers, the data providers and the science users, for disseminating information about the VO and gathering feedback. VO events in large astronomy meetings, such as the VO Special Session at the 2006 IAU General Assembly in Prague ("The Virtual Observatory in Action. New science, new technology and next generation facilities"), and the future EAS Symposium "Science with Virtual Observatories" at the August 2007 JENAM Meeting in Yerevan, are useful for providing general information but somehow disappointing, probably because they are not focused enough. Thus this Workshop, on a topic of particular interest for several national communities and the European Agencies as explained above.

The next sections summarise the lessons learnt from the discussions held during the Workshop, for data centres and for the VO teams, and the key issues which must be properly addressed in the near future.

2. LESSONS LEARNT

Some of the lessons learnt from the discussions at the Workshop are for data providers. We see a huge diversity in the data centre community, from large organisations to small teams willing to share their expertise through a 'niche' data base or service, and also a wide range in the data volumes to be provided. The advent of the VO in-

creases the incentive on the data centres to distribute their data, if possible in 'science ready' form, and to provide the proper data characterisation. The progressive growth in usage of VO-enabled services is likely to increase the impact of data centres and services, by allowing seamless access to them, including access from other data centres or services. More citations can be expected from this increased usage, in spite of the legitimate concern expressed during the meeting, that some users will not care to cite their information sources properly.

From the point of view of the VO teams, there are two fundamental requirements: on one hand, and this is the major driver of the VO endeavour, they have to take into account the science needs; on the other hand, they have to help the data centre managers to publish their data and services in the VO, taking into account the specific characteristics of each provider in terms of data, scope and organisation. Obviously more has to be done to provide templates for the data providers, information on available tools, and on-line tutorials. The Euro-VO DCA project is funded to support initial implementation of the VO framework, and the two Euro-VO Workshops will be major milestones: the first one, "How to publish data in the Virtual Observatory", will be held in June 2007 at ESAC, and the next one in June 2008 at ESO. Euro-VO DCA can also fund travels for discussion with VO specialists from another European country, and the partners are willing to help.

3. KEY TOPICS

Several themes which are keys to the success of the VO have been discussed during the Workshop.

3.1. Standards

We need the basic standards now: we have seen data providers impatient of providing their data in the VO, scientists eager to use it, and the window of opportunity is narrow.

The basic implementation and usage of the VO framework has to be easy: providing 'simple' access to data has to convey a limited overhead on the data centres, with the possibility to implement a more advanced layer for more sophisticated functionalities. Concerning this more advanced layer, there is a strong requirement from the scientists, to provide proper data characterisation. This includes information on data quality (in particular errors), with a proper propagation of this information and a proper usage of it in VO-enabled tools, to allow for an adequate usage of data. Data and added-value providers also want to get proper credit for their contributions, and so a proper description and propagation of information about the data producer(s) and curator(s) has to be implemented. But full characterisation information is not needed for some bona fide usage, and different levels of compliance have to be allowed. There will be anyway a strong pressure from the astronomers on data centres to get the proper metadata attached to data.

3.2. Tools

The scientists have stressed that the wrapping of widely used legacy services would facilitate community acceptance of the VO - but the discussions also showed that good new tools should be given a chance! The importance of providing communication between tools ("application messaging" such as PLASTIC, workflow management) has been stressed. There is also a need for scalability, in particular to develop protocols and tools able to perform data mining in large surveys.

One important issue for scientists using the VO, is that in some cases several tools and services may have similar aims, at least at first glance: how will we help each user to choose the best tool for his/her specific needs? can we (and do we want to) designate 'the best one'?

4. CONCLUSION

Seen from the VO teams, the discussions have been very useful, and we hope that the feeling is the same for all participants. There will be a report to Euro-VO and to IVOA on the community needs and feedback.

The main conclusion is that the VO will not do everything, but that it can do a lot. We have seen lots of expectations, which reinforces our motivation. We got confirmation that the standards we have developed are reasonably good, and tools are a good starting point. Lots remain to be done, and now we know more about it.

The Workshop has succeeded in attracting many participants, many more than the organisers had ever dreamt, well beyond the usual VO community. This seems thus to be a good format, provided that the topic is well chosen. The triggering work by the national projects has certainly been an important factor of success, as well as the commitment of the invited reviewers, who have provided several talks which will be used as a reference; of the audience for all the lively and enlightening discussions; of the four IVOA WG leads for their tireless participation; and of course of the organisers.

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REFERENCES

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