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VAMDC CONSORTIUM: A SERVICE TO ASTROPHYSICS

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Abstract. The VAMDC Consortium is a worldwide consortium which federates Atomic and Molecular databases through an e-science infrastructure and a political organisation. About 90% of the inter-connected databases handle data that are used for the interpretation of spectra and for the modelisation of media of many fields of astrophysics. This paper presents how the VAMDC Consortium is organised in order to provide a "service" to the astrophysics community.

Keywords: databases, software, atoms, molecules

1 Introduction

The VAMDC Consortium is issued from two european funded projects: the VAMDC (http://www.vamdc-project.vamdc.eu/) Dubernet et al. (2010) and the SUP@VAMDC (`http://www.sup-vamdc.vamdc.org/`) Zwölf et al. (2014) projects. The main scientific outcome of those two projects are: 1) an e-science infrastructure that interconnects about thirty databases (`http://www.vamdc.eu/activities/research`); 2) a political and technical organisation: "the VAMDC Consortium" that was launched on the 1rst November 2014 through the signature of a Memorandum of Understanding between 15 partners. This structure ensures the organisation and the sustainability of the VAMDC activities. The VAMDC Consortium activities cover 4 domains: research which is the most developed domain, education and industry that are currently in their early development stage, and outreach activities that will be carried out at their own pace depending on the public in contact with the VAMDC partners, and depending on the VAMDC partners' interest.

2 The Political and Technical organisation

The "VAMDC Consortium" Memorandum of Understanding (MoU) handles the following aspects: List of Members, Category of Memberships (Full, Associated Members); Governance with different bodies: Board of Directors, Executive Director Board, Scientific and Technical Board; Voting Rules; Entry into Force, Duration and Termination; Responsibility of members; Definition, Representation, Use of "VAMDC" Brand; Financial Provisions; Description of Activities; Use of foreground; Access Rights, Intellectual Property, List of "VAMDC" products (background).

This MoU is complemented by an "Internal Regulations" Document (IRD) describing in details the implementation of the MoU and a Roadmap that provides the general strategy of the VAMDC Consortium (`http://www.vamdc.eu` - see section "About us"/How to join us).

The Full Members take all decisions in the Board of Directors and both Full and Associated members are part of the Scientific and Technical Board that handles the maintenance, the development and the scientific activities of the VAMDC Consortium. A full description of the functionning can be found in the MoU, in the IRD and in the Roadmap.

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3 The Research Services

The Research Services are organised towards offering a common entry point to all databases thanks to the VAMDC portal (`http://portal.vamdc.eu`), towards offering the possibility to include new data and new databases within the VAMDC e-infrastructure, towards providing software librairies and modules that can be included into customers software, towards providing standalone users oriented software that retrieve and handle atomic and molecular data. The VAMDC e-infrastructure has evolved over the years through successive releases Rixon et al. (2011); Doronin et al. (2012); Dubernet et al. (2015) in order to arrive to the current version of standards and software (release version v12.07).

3.1 Portal

The portal (`http://portal.vamdc.eu`) is the major single entry point to all VAMDC connected databases. It allows a visibility on all available data in the VAMDC connected databases, and in many cases can be the first steps towards discovering data since those databases will respond if they contain the requested data. The portal has been recently upgraded with a new query interface for beginers, called "Guided Query", and the info section provides tutorials about how to use the different query modes. The tools to visualise the data are homogeneous among the databases and the description of the retrieved data, in particular of quantum numbers, is the same across all databases. Such uniformity implies that the portal cannot offer the same services as the traditionnal graphical user interface of the individual databases. This is the price to pay for accessing a wide range of data. Nevertheless an effort has been made to associate specific visualisation software to each databases (section 3 in in Fig. 1), and this section 3 will continue to improve in order to meet the users needs.

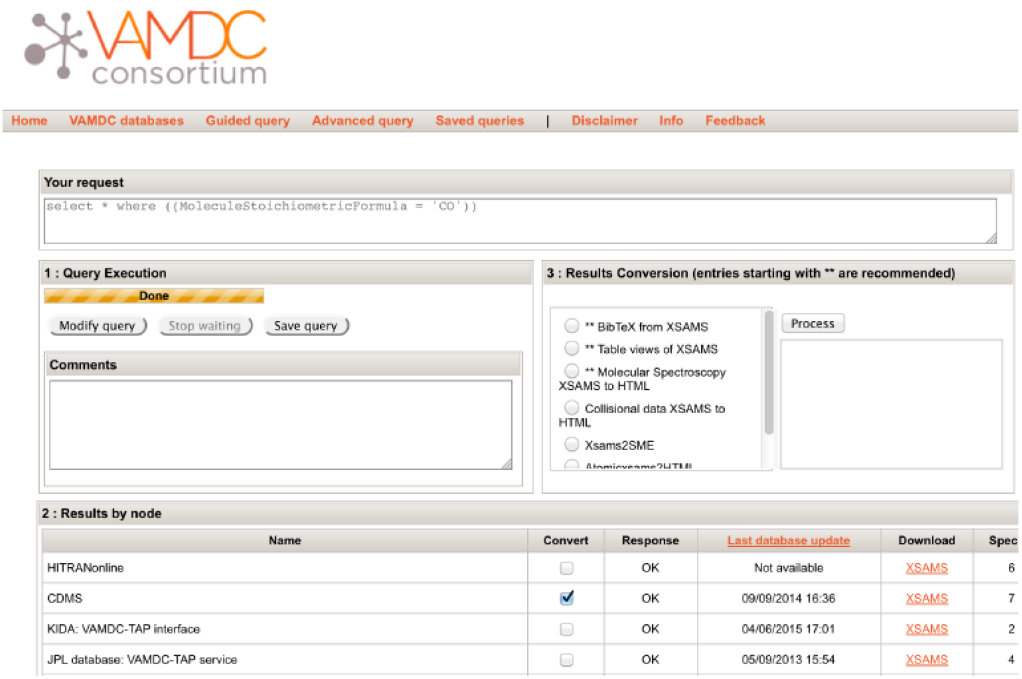

Fig. 1. Visualisation Page of VAMDC Portal

3.2 Services to include new databases

The current VAMDC e-infrastructure includes databases related to atomic and molecular spectroscopy and to heavy particle collisional processes, and is appropriate to the type of currently accessible data. Any producer of data can join the VAMDC infrastructure through different means: 1) they may include their data in existing atomic and molecular databases that are partners of VAMDC; 2) they may create a new database hosted by a partner of VAMDC; 3) they may create a new node in the VAMDC e-infrastructure. In case 1 and 2, the data producers can contact the databases managers directly, when the general support system (support@vamdc.eu)

should be contacted in the third case. Furthermore VAMDC aims to provide atomic and molecular data providers and compilers with a large dissemination platform for their work. Currently all products related to VAMDC, portal and tools, explicitly warn that the VAMDC users should cite both the original papers where the data have been published and the relevant databases.

3.3 Libraries and Software

The librairies, software modules and software can be found on the VAMDC website (`http://www.vamdc.eu/software`). The integration of those librairies are documented, supported via tutorials and illustrated in scientific use cases Dubernet et al. (2014). Among the scientific use cases, one might cite the SPECTCOL tool Dubernet et al. (2012) that allows to match spectroscopic data from CMDS Müller et al. (2005, 2012) andJPL (`http://spec.jpl.nasa.gov/`) with collisional data from BASECOL Dubernet et al. (2013)for interstellar applications, the access of VAMDC connected databases through the CASSIS software (`http://cassis.irap.omp.eu`), through the BASS2000 web portal (`http://bass2000.obspm.fr`), the MyXClass software Möller et al. (2015), through the SPECVIEW software (`http://www.stsci.edu/institute/software_hardware/specview/`). Users might want to create new librairies and software, and we provide support for those activities (support@vamdc.eu). The VAMDC Consortium can provide the following services to the users communities: 1) we can improve our current services and tools in order to meet the users requirements; 2) we can port the VAMDC capabilities and facilities into tools developed by institutes outside the consortium; 3) we can provide the scientific community with innovative tools for easily handling and processing results; 4) we can provide "derived products", i.e. products that combination of atomic and molecular data.

4 The Communication Services

The VAMDC Consortium has a large communication platform that is made available to producers and users of data.

The "VAMDC Consortium" communication activities occur through its main website that is the entry point for all customers from research, education, business, outreach, through a virtual tour of the "VAMDC Consortium" (`http://www.vamdc.org/virtual-tour/`) that describes partners and databases, through the News, the Events, the Blogs sections, through the social networks (Facebook, Twitter, ResearchGate, LinkedIn), through the natural channel of dissemination in conferences and workshops, through organising tutorials for different categories of users either through self-organisation or through joining other tutorials linked to atomic and molecular data or to e-infrastructure or to the application fields. We offer a Forum platform that can be used by any groups of data users and data producers. The above communication channels and tools can be used by external customers and by internal VAMDC Consortium members.

5 The Education Services

Education activities cover different target population and different methodologies. The target population is secondary school education, higher education and continuous education. The methodologies include the use of VAMDC in face-to-face education sessions or via on-line teaching. The Education activities are linked to the national Curriculae and must be displayed in the national language at least for all level below university degrees. Nevertheless the coupling of education activities in science and the use of english is often seen as attractive.

Our objectives for Education are the following (`http://www.vamdc.org/activities/education/`): to give easy access to atomic and molecular data and information related to these data; to provide innovative pedagogical resources in agreement with the national curriculae in order to illustrate lectures at all level of education; to re-inforce the link between research and education; to create national networks, and to interconnect them at the international level; to be partners of public institutions; to support teachers and lecturers, and bring them our knowledge on our scientific expertise linked to e-science; to offer training on the developed education tools.

6 Conclusion

The VAMDC Consortium continuously welcomes new members and is opened to welcome new type of data. Two main motivations would be considered in order to extend the scope of VAMDC Consortium: 1) a new community of data provider is interested to beneficiate from our experience and from part of our software,

2) one of our user community needs different types of data to be combined with the set of data already available in the VAMDC e-infrastructure. The inclusion of new types of data would certainly impact some of the "VAMDC Consortium" members, therefore the way of integration within the "VAMDC e-infrastructure" would be discussed within the Board of Directors, and the "VAMDC Consortium" members supporting such changes should make a case showing that this community is strategic for reasons such as increase of visibility, new customers, new stakeholders leading to consolidation of sustainability.

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