The Unified Astronomy Thesaurus

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Abstract. The Unified Astronomy Thesaurus (UAT) is an open, interoperable and community-supported thesaurus which unifies the existing divergent and isolated Astronomy & Astrophysics vocabularies into a single high-quality, freely-available open thesaurus formalizing astronomical concepts and their inter-relationships. The UAT builds upon the existing IAU Thesaurus with major contributions from the astronomy portions of the thesauri developed by the Institute of Physics Publishing, the American Institute of Physics, and SPIE. We describe the effort behind the creation of the UAT and the process through which we plan to maintain the document updated through broad community participation.

1. History

In astronomy, there have been different initiatives aimed at creating classification systems to be used in the literature. In 1992, Shobbrook and Shobbrook published a 2,551-term thesaurus which was endorsed by the IAU \cite{Shobbrook & Shobbrook 1992} and named the IAU Thesaurus. Meanwhile, editors from the main astronomy journals developed a parallel system of keywords to characterize and indexed published articles called “Astronomy Subject Headings” (or more commonly simply “journal keywords”) which was adopted by the journals also in 1992. This system, consisting of just over 300 concepts organized in a hierarchy, was considered simpler to use than the IAU Thesaurus and appropriate for creating the annual subject heading index used for browsing the content of the journals. With the passing of time, limitations of this system have become apparent, yet it continues to be used today in all the major astronomy publications. In 2007 the International Virtual Observatory Alliance (IVOA) Semantics Working Group published a study on the use of vocabularies in the Virtual Observatory \cite{Gray et al. 2009} and \cite{Derriere et al. 2011}, providing versions of the IAU Thesaurus and the astronomy subject headings in SKOS (Simple Knowledge Organization System, \cite{Miles & Bechhofer 2009}) format.
Outside of astronomy, the American Institute of Physics (AIP), on behalf of the publishers in the field, developed a more comprehensive classification system which included astronomy terms. Named PACS (Physics and Astronomy Classification System), the keywords were originally proposed in 1975 and have been used to characterize content in most of the major physics journals until 2011, when AIP announced that they would stop maintaining and using this classification scheme in favor of a more modern system. With the end of PACS, the physics community found itself without a common system for classifying new journal articles, and in the fall of 2011 a group of physics and astronomy publishers met to explore the possibility of joining forces in developing a modern system to support the classification and semantic enrichment of the literature (the new thesaurus’s lineage is illustrated in Figure 1). Participants included members of the astronomical community involved in the publications and curation journal articles, including representatives from ADS, the CfA Wolbach Library, and the Institute of Physics (IOP), the publisher of AAS journals.

Recognizing the danger of having different publishers develop separate thesauri based on the content that they managed, a key group of participants at the meeting felt that there was an opportunity to collaborate on the development of a single system covering at least astronomy and astrophysics. IOP and AIP, in collaboration with ADS, the CfA Wolbach Library and the IVOA Semantics working group began discussing the possibility of working together on a single astronomy thesaurus created by merging and reconciling existing and emerging vocabularies and thesauri. As the plans to create a unified thesaurus were taking shape, the American Astronomical Society (AAS) joined the effort and provided logistical and legal support helping negotiate the licensing terms for the final work. Having settled issues related to intellectual rights in the fall of 2012, AIP and IOP proceeded to donate the astronomy portions of their thesauri and funded an effort to merge them with the IVOA-enhanced version of the IAU thesaurus. The resulting work, newly named the Unified Astronomy Thesaurus, was born.

2. Current Status

The Unified Astronomy Thesaurus is available under a Creative Commons License (CC-BY-SA), ensuring its widest use while protecting the intellectual property of the contributors. While it is being managed by the original core group of people, we envision that its development and maintenance will be stewarded by a broader group of parties having a direct stake in it. This includes professional associations (IVOA, IAU), learned societies (AAS, RAS), publishers (IOP, AIP), librarians and other curators working for major astronomy institutes and data archives.

While the main impetus behind the creation of a single thesaurus has been the wish to support semantic enrichment of the literature, we expect that use of the UAT (along with other vocabularies and ontologies currently being developed in our community) will be much broader and will stimulate the development of a wide range of astronomy resources, including data products and services.

There are a number of differences which distinguish the UAT from the prior efforts in this area, and which are worth mentioning: **Openness**: the UAT is licensed under liberal terms, and can therefore be easily integrated in workflows and applications at no cost. Additionally, anyone interested in astronomy can contribute to the UAT by suggesting additions, refinements, revisions and modifications to it. **Interoperability**: the UAT is available as a SKOS document, a standard open format which facilitates its
embedding and re-use in larger contexts. **Community support:** The UAT is supported by major stakeholders in the astronomical community, including journal publishers, professional societies, libraries and archives, and VO-related projects.

### 3. Curation and Development

Astronomy and Astrophysics are relatively fast-changing disciplines, where new theories and discoveries (like dark energy and exoplanets) spawn new research fields on a regular basis. Since one of the main goals of the UAT is to provide a formal language that can be used to describe this entire field, we need to ensure that the UAT remains a living document, regularly updated and revised to capture any new concepts being introduced in the scholarly literature. Here is where we hope technology will come to our aid: contrary to some of the prior efforts which required a great amount of manual work to review all the published literature, we plan to use text mining tools to detect and suggest new terms for inclusion as they appear in new papers. The process supporting this activity is currently being developed by publishers and ADS to discover topics discussed in papers and classify them appropriately.

In our effort to make the community aware of the efforts behind the UAT, in late 2012 we launched a website to provide information on the status of the thesaurus and as a way to disseminate it. The home of the UAT is now: [http://astrothesaurus.org](http://astrothesaurus.org)

In addition to the most recent release of the thesaurus, the website provides a browsable
interface allowing users to view the concepts in the thesaurus and their relationships. We encourage all interested parties to stay up to date by accessing the information available on the website and by participating in the on-line discussion on the UAT mailing list (subscription information also available from the website). The thesaurus is currently being reviewed for accuracy and consistency while we finalize the curatorial process, with a full release scheduled in 2014.

On the grounds that the best curation of a new thesaurus can only be provided by the community itself, we intend to enhance the existing web interface to allow not only the UAT to be browsed, but also enable anyone to identify and suggest additions, changes and improvements to terms within the UAT. These suggestions will be filtered through volunteer editors (astronomers or subject matter experts) and entered into the UAT with credit to the contributor and editor. Periodically, a librarian will review and tune the overall structure before re-releasing it, allowing the editors to focus solely on reviewing the suggestions made by users. The involvement of the astronomical community – with the development work led by the CfA Wolbach Library and ADS – will help the UAT remain an up-to-date, accurate and trusted resource for the community as a whole.

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