

An interactive service for cosmic dust catalogs at the IDIS Small Bodies and Dust Node

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Abstract

We present a web based interactive data service allowing an easy retrieval and analysis of cosmic dust repositories. Our tool allows to search dust particles using several criteria: shape, size interval, luster, transparency or curator classification. For each particle it is possible to show the SEM(Scanning Electron Microscopy) image, the EDS (X-ray Energy-Dispersive Spectrometry) spectra and other descriptive data.

This service has been developed as a resource of the Europlanet Small Bodies and Dust Node and is available at this URL: <http://www.iaps.roma.inaf.it:8080/web/sbdn/cosmic-dust-catalog>.

1. Introduction

The direct collection of interplanetary dust in the Earth stratosphere is an effective tool for the understanding of the formation and evolution of our planetary system; the collection of interstellar grains, that penetrate in terrestrial stratosphere [2], can give us insights about the interaction between the Solar System and the Local Interstellar Medium. The upper stratosphere is a suitable environment where to collect cosmic particles, thanks to the low contamination with terrestrial materials and to the high concentration of extraterrestrial particles. In the early phases of the Solar System formation, dust particles were embedded into icy protoplanets during the accretion of planetesimals, thus remaining stored in the outer Solar System at very low temperatures (10-50 K); during the dynamical evolution of these icy objects, thanks to collisions, dust particles are released as debris from their parent bodies; so interplanetary dust particles (IDPs) can contain a record of physical, chemical and mineralogical processes that took place in the early stages of the

primordial Solar System [6]. IDPs are typically in the size range 10 – 100 μm ; particles in this size range can survive the atmospheric entry without being totally vaporized by the heating due to the friction with the atmosphere. These particles have been collected in the lower and upper stratosphere by NASA U2 aircrafts and balloons since the '70s. Comets are the main source of IDPs, other sources are asteroids and Kuiper Belt objects. The study of IDPs can help to solve scientific questions in planetology, in astrophysics, in astrobiology, and also in atmospheric sciences.

2. Service Functionalities

This service is web based and doesn't require any client side installation. By opening the URL into the web browser, the user will be able to search inside the dust catalog and to show specific properties of the selected IDPs.

2.1 Catalog details

Currently, we have implemented the full NASA Cosmic Dust Catalog volume 15, which comprises 467 particles collected on January-February and June-July 1994, during 51.8 hours of stratospheric exposure, with large area (300 cm^2) dust collectors mounted on a NASA ER-2 aircraft. The grains have been analyzed with a SEM, equipped with a Si(Li) detector and PGT 4000T analyzer for X ray energy-dispersive spectrometry. Both the SEM image and the spectrum in the 0-10 KeV range for each particle has been obtained.

It is currently under development the integration of the volume 18 of the same NASA collection program: the new catalog will be available in the same service, thus allowing the user to perform a

single search on both catalogs and browsing the results in a seamless way.

2.2 Search engine

The graphical user interface will show the applicable filters to be used for searching inside the catalog, as shown in figure 1.

Type	Shape	Luster	Transparency	Size
<input type="checkbox"/> C	<input type="checkbox"/> S	<input type="checkbox"/> D	<input type="checkbox"/> T	Greater than <input type="text"/> micron
<input type="checkbox"/> TCA	<input type="checkbox"/> E	<input type="checkbox"/> M	<input type="checkbox"/> SM	Smaller than <input type="text"/> micron
<input type="checkbox"/> TCN	<input type="checkbox"/> O	<input type="checkbox"/> O	<input type="checkbox"/> SV	
<input type="checkbox"/> AOS	<input type="checkbox"/> P	<input type="checkbox"/> V	<input type="checkbox"/> TL	
	<input type="checkbox"/> R	<input type="checkbox"/> R	<input type="checkbox"/> O	

Figure 1 : Search filters

Filters are grouped into five characteristics: type, shape, luster, transparency and size. Each characteristic allow several values. Selecting a check box the relative characteristic will be used as a search criteria, including only the particles having that value satisfied. Selecting multiple values for the same characteristic will apply the logical disjunction of that values in the search criteria (i.e. 'S' and 'T' for Shape will search for particles having spherical OR irregular shape). Differently, selecting multiple values for separate characteristics will apply the logical conjunction of that values in the search criteria (i.e. 'C' for Type and 'O' for Transparency will search for grains of extraterrestrial origin AND opaque).

2.3 Particle data

Query results are visualized in a table: one row for each IDP. Clicking on a row will open a non-modal sub-window with particle data. It is possible to click multiple times on different rows to tile and compare the particle windows. The particle data window has three sections : the SEM image (figure 2), the EDS spectra and the original PDF page from the dust catalog containing the summary.

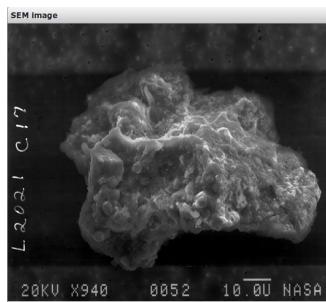


Figure 2 : SEM image

3. Conclusions

We believe our service represents an interesting and useful tool for cosmic dust research activity. Its clean graphical interface is comfortable for both scientific staff and for people having general interest on the subject. The future extensions with more catalogs (the volume 18 is already on the way) will make this service even more appealing and constitute a reference implementation for cosmic dust analysis tools. In a virtual observatory approach, we are also planning to expose this service as a Planetary Science Table Access Protocol service [3].

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