PDS APIs

Release B12.1

NASA Planetary Data System

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CONTENTS

The Planetary Data System (PDS) is a federated system of nodes that archive planetary science data.

The PDS Application Programming Interface (API) provides a consistent way for planetary science community to discover and share archival data across PDS. This API is one of the cornerstone applications for providing an integrated worldwide data services platform that enables the efficient discovery, dissemination, use and analysis of internationally sponsored planetary science archives.

PDS is willing to develop ReST-ful web APIs for different applications (so far, registry, dois).

These pages document how to access these APIs.

This web site is also available as a PDS document

CHAPTER

ONE

OVERVIEW

The PDS API base urls are provided under the following pattern:

```
https://pds.nasa.gov/api/{service}/{version}/{service_path+params}
```

where:

- {service}: the service such as 'search' (i.e. registry), 'doi', etc.. This component can have an optional node identifier (e.g. 'search-geo'). Absence of a node implies EN.
- {version}: the version of the service.
- {service_path+params}: the ReST path for the service, including any query parameters - this is essentially the remaining portion of the URI after the version.

So for example:

```
https://pds.nasa.gov/api/search-geo/0.4/products?limit=10
```

intends to obtain 10 product entries from the 0.4.2 version of the GEO node's search (registry).

The API specifications design is driven by the PDS API general conventions

CHAPTER

TWO

PDS SEARCH API USER GUIDE

Note: The current guide is based on the PDS Search API version 0.4

Warning: Since our servers are not fully populated with all PDS data sets, the examples presented in this user guide may return empty results or 404 (Not Found) errors. If there is a data set you would like added, please contact the PDS Help Desk for assistance.

The PDS Search API provides endpoints:

- to **search** for bundles, collections and any PDS products with advanced search queries.
- to **browse** the archive hierarchically downward (e.g. collection's products) or upward (e.g. bundles containing products),
- to **resolve** an identifier (lid or lidvid) and retrieve the product label and data where ever it is in the Planetary Data System.

These pages provide a user guide for the PDS Search API.

2.1 Quickstart

The following section provides a quickstart guide to try out the PDS Search API.

Warning: Since our servers are not fully populated with all PDS data sets, the examples presented in this user guide may return empty results or 404 (Not Found) errors. If there is a data set you would like added, please contact the PDS Help Desk for assistance.

2.1.1 Prerequisites

- curl command line tool (curl is available in many operating systems by default. If not, you can get curl from https://curl.se/ or using a package management tool specific to your operating system).

2.1.2 Search With curl

1. Open a Terminal window (or your favorite command-line application).
2. Get 5 products' metadata from the API in JSON format:

```
curl -X GET --header 'Accept: application/json' 'https://pds.nasa.gov/api/search/0.4/products?limit=5'
```

3. Get 5 products' metadata from the API in XML format:

```
curl -X GET --header 'Accept: application/xml' 'https://pds.nasa.gov/api/search/0.4/products?limit=5'
```

4. To view this in a more readable way, you can pipe the output to a file, or pretty print (on Mac/Unix):

```
# Output JSON to a File
curl ... > my_first_query.json

# Pretty print JSON
curl ... | json_pp > my_first_query.json

# Output XML to a File
curl ... > my_first_query.xml
```

More details on how to use the API can be found in the *endpoints* .

2.1.3 Search with Python

Alternatively, it is possible to use other tools such as Postman and programming languages such as Python to call the PDS Search API.

To use the **PDS API Python Client**, you can read this other Quickstart

2.2 PDS Search API Queries

Warning: Since our servers are not fully populated with all PDS data sets, the examples presented in this user guide may return empty results or 404 (Not Found) errors. If there is a data set you would like added, please contact the PDS Help Desk for assistance.

2.2.1 Endpoints

The base URIs for performing GET requests for searching PDS data are as follows.

The **base URL** of the PDS Search API, for all the PDS nodes, is:

```
https://pds.nasa.gov/api/search/0.4/
```

For specific discipline node search, there are node-specific endpoints available giving access to products of one node, for example:

```
https://pds.nasa.gov/api/search-geo/0.4/
```

Where geo is the **Node ID**

The **Node IDs** are:

The main use cases, to search, crawl products or resolve a product identifier are given in the following sections.

2.2.2 Search Products

Request Example

Search for the 10 latest collections which processing level is “Raw”:

```
curl --location --request GET 'https://pds.nasa.gov/api/search/0.4/collections?limit=10&
↪q=(pds:Primary_Result_Summary.pds:processing_level eq "Raw")'
```

Request Template

The requests template is a follow:

```
GET https://pds.nasa.gov/api/search/0.4/{product_class}[?[{query-parameter}={query-parameter-value}
↪]*]
```

Where *product_class* is one of:

- **products**: search among all classes of products (observational products, collections, bundles…)
- **collections**: search among products which class is product_collection
- **bundles**: search among products which class is product_bundle

Query Detailed Syntax

Query Parameters

The query parameters are:

Query Parameter	Description	Example
q	(Optional, string) Query string you wish to parse and use for search. See *query string syntax*	q=target_name eq "Mars"
keyword	(Optional, string) String used for text search on title and description of the PDS4 labels	insight
fields	(Optional, array of strings) Array of fields you wish to return.	fields=lid,Time_Coordinates.start_date_
start	(Optional, integer, default=0) The search result to start with in the returned records. For instance, start=10 will return records 10-19. Useful for pagination of the results.	start=100
limit	(Optional, integer, default=100) The number of records/results to return.	limit=100
sort	(Optional, string, default=LIDVID) Field to sort on and whether it should be sorted ascending (ASC) or descending (DESC). *fieldName asc* or *fieldName desc*. There can be several sort parameters (order is important).	sort=lidvid asc, Time_Coordinates.start_date_time desc
summary-only	(Optional, boolean, default=False) When true, only the summary of the results is returned, not the individual results	true

q and *fields* use PDS4 *Fields Dot Notation*

Query String Syntax

An example of query syntax (*q* query parameter) is:

For example:

```
((pds:Primary_Result_Summary.pds:processing_level eq "Raw") and not (ops:Data_File_Info.ops:file_
↪size ge 8942))
```

The query syntax follows the rules:

```
{query} = {comparison}|{group}

{comparison} = {field} {comparison operator} {literal value}

{group} = [not] ({comparison} [[and|or] {group}])
```

- **{field}** follows the *Fields Dot Notation* . The available fields can be found in responses *summary* object, *properties* attribute.
- **{comparison operator}** are eq, ne, gt, lt, ge, le
- **{literal value}** is either a string between " (double quotes) or a numerical value (float or integer). Wildcards (*, ?) are supported in strings.

Operator	Description	Example
Comparison Operators		
eq	Equal	target_name **eq** “Mars”
ne	Not equal	target_name **ne** “Saturn”
gt	Greater than	Time_Coordinates.start_date_time **gt** 2001-05-10T00:00:00Z
ge	Greater than or equal	Time_Coordinates.start_date_time **ge** 2001-05-10T00:00:00Z
lt	Less than	Time_Coordinates.start_date_time **lt** 2020-06-01T00:00:00Z
le	Less than or equal	Time_Coordinates.start_date_time **le** 2020-06-01T00:00:00Z
Logical Operators		
and	Logical and	target_name **eq** “Mars” **and** instrument_name **eq** “hirise”
or	Logical or	target_name **eq** “Mars” **or** target_name **eq** “Phobos”
not	Logical negation	**not** target_name **eq** “Mars”
Grouping Operators		
( )	Precedence grouping	((target_name **eq** “Mars” **or** target_name **eq** “Phobos”) **and** (instrument_name **eq** “hirise”))

Fields Dot Notation

General Case

The syntax of the field names use a combination of the PDS4 Information Model and dot notation representations of an XML XPaths.

Query parameters will use a combination of an attribute with its parent class in *all lowercase*:

```
{namespace:parent_class}.{namespace:attribute}
```

For example:

```
pds:Science_Facets.pds:discipline_name
pds:Investigation_Area.pds:type
```

**NOT IMPLEMENTED*

In the event that the {parent_class}.{attribute} combination does sufficiently guarantee uniqueness or sufficiency of search when a class is inherited by multiple classes, additional ancestor classes should be prepended to the query parameter until sufficient uniqueness is attained:

{ns:ancestor_class}.{ns:parent_class}.{ns:attribute}

If the query parameter grows beyond 3 ancestor classes, a *custom query parameter* should be considered.

NOT IMPLEMENTED

In the event that multiple attributes are to be grouped together for search, the parent class should be used as the query parameter:

{ancestor_class}.{parent_class}

Custom Query Parameters

NOT IMPLEMENTED

There are several cases where custom query parameters are preferred over the Dot Notation, but should only be avoided wherever possible in order to minimize confusion amongst developers attempting to use the API. These are also subject to approval by Search Integration Working Group representative for each node. That member is responsible for providing those updates to Engineering Node.

Some reasons for custom query parameters:

- Combination of multiple attribute values into one
- Special cases where XQuery needs to be used for finding specific values (e.g. instrument/spacecraft described in Observing_System_Component class)
- Custom search fields on non-PDS4 metadata (e.g. image tags, operations note, etc.)
- Support common search or PDS4 terminology (e.g. target_name, lidvid)

2.2.3 Resolve A Product Identifier

Default Resolution

If you know the lid (for example urn:nasa:pds:insight_rad) or lidvid (for example urn:nasa:pds:insight_rad::2.1) identifier of a product, you can retrieve its description, whereever it is managed in the PDS system, with the following request:

```
https://pds.nasa.gov/api/search/0.4/products/{identifier}
```

For example

```
curl --location --request GET 'https://pds.nasa.gov/api/search/0.4/products/urn:nasa:pds:insight_rad::2.1
↪' --header 'Accept: application/json'
```

Search for Latest vs. All Versions

Latest Version

By default, when the identifier is a lid (without a version, for example urn:nasa:pds:insight_rad) only the latest description of the product is returned.

The request:

```
https://pds.nasa.gov/api/search/0.4/products/{lid}
```

is equivalent to:

```
https://pds.nasa.gov/api/search/0.4/products/{lid}/latest
```

All Versions

If you want to retrieve **all** the versions of a product, the request is:

```
https://pds.nasa.gov/api/search/0.4/products/{lid}/all
```

The *all* and *latest* suffixes apply also to all the crawling end-points which description follows.

2.2.4 Crawl a Data Set Hierarchy

For a given product with identifier *lidvid1*, you can browse its parent products or children.

If the Product 'lidvid1' Is a Bundle

Get its **collections**:

```
https://pds.nasa.gov/api/search/0.4/bundles/lidvid1/collections[/[all|latest]]
```

For example, run:

```
curl --location --request GET 'https://pds.nasa.gov/api/search/0.4/bundles/urn:nasa:pds:insight_rad::2.1/
↪collections' --header 'Accept: application/json'
```

Get its **observational products**:

```
https://pds.nasa.gov/api/search/0.4/bundles/lidvid1/products[/[all|latest]]
```

If the Product 'lidvid1' Is a Collection

Get its **bundle**:

```
https://pds.nasa.gov/api/search/0.4/collections/lidvid1/bundles[/[all|latest]]
```

Get its **observational products**:

```
https://pds.nasa.gov/api/search/0.4/collections/lidvid1/products[/[all|latest]]
```

If the Product 'lidvid1' Is an Observational Product

Get its **bundle**:

```
https://pds.nasa.gov/api/search/0.4/products/lidvid1/bundles[/[all|latest]]
```

Get its **collection**:

```
https://pds.nasa.gov/api/search/0.4/products/lidvid1/collections[/[all|latest]]
```

2.3 PDS Search API Response Formats

2.3.1 Content Negotiation

A simple style of content negotiation is used to match the format requested by the client and the capability of the server.

The client can specify the desired response format by including the HTTP header *Accept*. If no *Accept* header is present in the request, or if the requested content type is not available, the server will provide the response in JSON format by default.

The following table provides a list of the supported HTTP Accept header types:

Accept Header	Format	Note
application/json	JSON	Simplified JSON view of the PDS4 metadata label. Contains "flattened" PDS4 properties extracted from the metadata label
application/xml	XML	Same as application/json, but in an XML
application/vnd.nasa.pds.pds4+json	JSON	JSON response containing the full PDS4 metadata translated to JSON, along with some additional supplemental
application/vnd.nasa.pds.pds4+xml	XML	Same as application/vnd.nasa.pds.pds4+json, but in an XML format. This response format contains the original PDS4 labels.
application/kvp+json	JSON	JSON response containing key-value-pairs for the applicable metadata.
text/csv	CSV	Returns a CSV table containing values for the parameters in the request. If no parameters were specified in the request, a default set is returned. The first row of the CSV is a header that describes the values in each column.
text/html	HTML	JSON response embedded in an HTML body. This format is provided for requests coming from the browers (e.g. Google Chrome) URL bar.

application/vnd.nasa.pds.pds4+json and *application/vnd.nasa.pds.pds4+xml* have been chosen to comply with RFC6838

2.3.2 Examples

application/json

The request:

```
curl --location --request GET 'http://pds.nasa.gov/api/search/0.4/products/urn:nasa:pds:insight_rad::2.1
↪' --header 'Accept: application/json'
```

Returns

```
{
   "id": "urn:nasa:pds:insight_rad::2.1",
   "type": "Product_Bundle",
   "title": "Mars InSight Lander Radiometer Data Archive",
   "start_date_time": "2018-05-05T00:00:00Z",
   "stop_date_time": "3000-01-01T00:00:00.000Z",
   "investigations": [
      {
```

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```
            "id": "urn:nasa:pds:context:investigation:mission.insight",
            "href": "http://localhost:8080/products/urn:nasa:pds:context:investigation:mission.insight"
        }
    ],
    "observing_system_components": [
        {
            "id": "urn:nasa:pds:context:instrument_host:spacecraft.insight",
            "href": "http://localhost:8080/products/urn:nasa:pds:context:instrument_host:spacecraft.insight"
        },
        {
            "id": "urn:nasa:pds:context:instrument:radiometer.insight",
            "href": "http://localhost:8080/products/urn:nasa:pds:context:instrument:radiometer.insight"
        }
    ],
    "targets": [
        {
            "id": "urn:nasa:pds:context:target:planet.mars",
            "href": "http://localhost:8080/products/urn:nasa:pds:context:target:planet.mars"
        }
    ],
    "metadata": {
        "label_url": "/data/bundle_insight_rad.xml",
        "update_date_time": "2018-02-01T00:00:00Z",
        "version": "2.1"
    },
    "properties": {
        "pds:Stream_Text.pds:name": [
            "Introduction to the Radiometer Data Bundle"
        ],
        "pds:Modification_Detail.pds:description": [
            "Pre-peer review version",
            "First release",
            "The collections urn:nasa:pds:insight_rad:data_calibrated and urn:nasa:pds:insight_rad:data_
↪derived were added to this bundle with InSight Release 1b.",
            "Changed Observing_System_Component name in this label from RAD to RADIOMETER to␣
↪match context product name. Expanded Citation_Information description."
        ],
        "..."
        "pds:Investigation_Area.pds:type": [
            "Mission"
        ]
    }
}
```

application/xml

The request:

```
curl --location --request GET 'http://pds.nasa.gov/api/search/0.4/products/urn:nasa:pds:insight_rad::2.1
↪' --header 'Accept: application/xml'
```

Returns:

```
<PdsProduct xmlns="http://pds.nasa.gov/api">
   <id>urn:nasa:pds:insight_rad::2.1</id>
   <type>Product_Bundle</type>
   <title>Mars InSight Lander Radiometer Data Archive</title>
   <description/>
   <start_date_time>2018-05-05T00:00:00Z</start_date_time>
   <stop_date_time>3000-01-01T00:00:00.000Z</stop_date_time>
   <investigations>
      <investigations>
         <title/>
         <id>urn:nasa:pds:context:investigation:mission.insight</id>
         <href>http://localhost:8080/products/urn:nasa:pds:context:investigation:mission.insight</href>
         <type/>
         <description/>
      </investigations>
   </investigations>
   <observing_system_components>
      <observing_system_components>
         <title/>
         <id>urn:nasa:pds:context:instrument_host:spacecraft.insight</id>
         <href>http://localhost:8080/products/urn:nasa:pds:context:instrument_host:spacecraft.insight
↪</href>
         <type/>
         <description/>
      </observing_system_components>
      <observing_system_components>
         <title/>
         <id>urn:nasa:pds:context:instrument:radiometer.insight</id>
         <href>http://localhost:8080/products/urn:nasa:pds:context:instrument:radiometer.insight</
↪href>
         <type/>
         <description/>
      </observing_system_components>
   </observing_system_components>
   <targets>
      <targets>
         <title/>
         <id>urn:nasa:pds:context:target:planet.mars</id>
         <href>http://localhost:8080/products/urn:nasa:pds:context:target:planet.mars</href>
         <type/>
         <description/>
      </targets>
   </targets>
   <metadata xmlns="">
      <archive_status xmlns="http://pds.nasa.gov/api"/>
```

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```
      <creation_date_time xmlns="http://pds.nasa.gov/api"/>
      <label_url xmlns="http://pds.nasa.gov/api">/data/bundle_insight_rad.xml</label_url>
      <update_date_time xmlns="http://pds.nasa.gov/api">2018-02-01T00:00:00Z</update_date_
↪time>
      <version xmlns="http://pds.nasa.gov/api">2.1</version>
   </metadata>
   <properties>
      <pds:Stream_Text.pds:name>Introduction to the Radiometer Data Bundle</pds:Stream_Text.
↪pds:name>
      <pds:Modification_Detail.pds:description>Pre-peer review version</pds:Modification_Detail.
↪pds:description>
      ...
      <pds:Investigation_Area.pds:type>Mission</pds:Investigation_Area.pds:type>
   </properties>
</PdsProduct>
```

application/vnd.nasa.pds.pds4+json

The request:

```
curl --location --request GET 'http://pds.nasa.gov/api/search/0.4/products/urn:nasa:pds:insight_rad::2.1
↪' --header 'Accept: application/vnd.nasa.pds.pds4+json'
```

Returns:

```
{
   "id": "urn:nasa:pds:insight_rad::2.1",
   "meta": {
      "node_name": "PDS_ENG",
      "ops:Label_File_Info": {
         "ops:file_name": "bundle_insight_rad.xml",
         "ops:file_ref": "/data/bundle_insight_rad.xml",
         "ops:creation_date": "2020-01-15T17:40:30Z",
         "ops:file_size": "6805",
         "ops:md5_checksum": "adfd86bbf2573c37d862e27e08f332db"
      },
      "ops:Data_Files": [
         {
            "ops:file_name": "readme.txt",
            "ops:file_ref": "/data/readme.txt",
            "ops:creation_date": "2020-01-03T17:58:09Z",
            "ops:file_size": "1114",
            "ops:md5_checksum": "192de32c12437c180a9e14d60fe4b89a",
            "ops:mime_type": "text/plain"
         }
      ],
      "ops:Tracking_Meta": [
         {
            "ops:archive_status": "archived"
         }
      ]
```

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```
    },
    "pds4": {
        "Product_Bundle": {
            "Identification_Area": {
                "product_class": "Product_Bundle",
                "Modification_History": {
                    "Modification_Detail": [
                        {
                            "modification_date": "2018-02-01",
                            "description": "Pre-peer review version",
                            "version_id": 0.1
                        },
                        {
                            "modification_date": "2019-04-22",
                            "description": "First release",
                            "version_id": 1
                        },
                        "..."
                    ]
                },
                "information_model_version": "1.11.0.0",
                "logical_identifier": "urn:nasa:pds:insight_rad",
                "version_id": 2.1,
                "Citation_Information": {
                    "publication_year": 2018,
                    "description": "The InSight Radiometer data bundle consists of data in three collections:\
↪r\n                data_raw, data_calibrated, and data_derived.\r\n                The bundle also␣
↪includes the HP3/RAD Software Interface Specification in \r\n                the HP3/RAD document␣
↪collection.",
                    "author_list": "InSight RAD Science Team",
                    "doi": "10.17189/1517568"
                },
                "title": "Mars InSight Lander Radiometer Data Archive"
            },
            "..."
        }
    }
}
```


pds4 property contains a translation in JSON of the PDS4 XML Label.

application/vnd.nasa.pds.pds4+xml

The request:

```
curl --location --request GET 'http://pds.nasa.gov/api/search/0.4/products/urn:nasa:pds:insight_rad::2.1
↪' --header 'Accept: application/vnd.nasa.pds.pds4+xml'
```

Returns:


```
<pds_api:product xmlns:pds_api="http://pds.nasa.gov/api" xmlns:ops="https://pds.nasa.gov/pds4/
↪ops/v1">
```


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```
  <pds_api:id>urn:nasa:pds:insight_rad::2.1</pds_api:id>
  <pds_api:meta>
    <node_name>PDS_ENG</node_name>
    <ops:Label_File_Info>
      <ops:file_name>bundle_insight_rad.xml</ops:file_name>
      <ops:file_ref>/data/bundle_insight_rad.xml</ops:file_ref>
      <ops:creation_date>2020-01-15T17:40:30Z</ops:creation_date>
      <ops:file_size>6805</ops:file_size>
      <ops:md5_checksum>adfd86bbf2573c37d862e27e08f332db</ops:md5_checksum>
    </ops:Label_File_Info>
    <ops:Data_Files>
      <ops:Data_Files>
        <ops:file_name>readme.txt</ops:file_name>
        <ops:file_ref>/data/readme.txt</ops:file_ref>
        <ops:creation_date>2020-01-03T17:58:09Z</ops:creation_date>
        <ops:file_size>1114</ops:file_size>
        <ops:md5_checksum>192de32c12437c180a9e14d60fe4b89a</ops:md5_checksum>
        <ops:mime_type>text/plain</ops:mime_type>
      </ops:Data_Files>
    </ops:Data_Files>
    <ops:Tracking_Meta>
      <ops:Tracking_Meta>
        <ops:archive_status>archived</ops:archive_status>
      </ops:Tracking_Meta>
    </ops:Tracking_Meta>
  </pds_api:meta>
  <pds_api:pds4>
    <Product_Bundle
  xmlns="http://pds.nasa.gov/pds4/pds/v1"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://pds.nasa.gov/pds4/pds/v1 https://pds.nasa.gov/pds4/pds/v1/PDS4_
↪PDS_1B00.xsd">
      <Identification_Area>
        <logical_identifier>urn:nasa:pds:insight_rad</logical_identifier>
        <version_id>2.1</version_id>
        <title>Mars InSight Lander Radiometer Data Archive</title>
        <information_model_version>1.11.0.0</information_model_version>
        <product_class>Product_Bundle</product_class>
        <Citation_Information>
          <author_list>InSight RAD Science Team</author_list>
          <publication_year>2018</publication_year>
          <doi>10.17189/1517568</doi>
          <description>
        The InSight Radiometer data bundle consists of data in three collections:
        data_raw, data_calibrated, and data_derived.
        The bundle also includes the HP3/RAD Software Interface Specification in
        the HP3/RAD document collection.
      </description>
        </Citation_Information>
        ...
      </Identification_Area>
      ...
```

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```
      </Product_Bundle>
   </pds_api:pds4>
</pds_api:product>
```

The tag *pds_api:pds4* contains the XML PDS4 label.

application/kvp+xml

This format is useful when one only need a few fields from the metadata.

The request:

```
curl --location --request GET 'http://pds.nasa.gov/api/search/0.4/products?limit=10&fields=lidvid&
↪fields=title' --header 'Accept: application/kvp+json'
```

Returns:

```
{
 "summary": {
    "q": "",
    "hits": 17,
    "took": 55,
    "start": 0,
    "limit": 10,
    "sort": [],
    "properties": [
       "lidvid",
       "title"
    ]
 },
 "data": [
    {
       "lidvid": "urn:nasa:pds:insight_rad:data_derived::7.0",
       "title": "InSight RAD Derived Data Collection"
    },
    {
       "lidvid": "urn:nasa:pds:insight_rad:data_raw::8.0",
       "title": "InSight RAD Raw Data Collection"
    },
    "..."
 ]
}
```

text/csv

This format is useful when one only need a few fields from the metadata.

The request:

```
curl --location --request GET 'http://pds.nasa.gov/api/search/0.4/products?limit=10&fields=lidvid&
↪fields=title' --header 'Accept: text/csv'
```

Returns:

```
lidvid,title
"urn:nasa:pds:insight_rad:data_derived::7.0","InSight RAD Derived Data Collection"
"urn:nasa:pds:insight_rad:data_raw::8.0","InSight RAD Raw Data Collection"
"urn:nasa:pds:insight_rad:data_derived:hp3_rad_der_00014_20181211_073042::1.0","InSight HP3␣
↪Radiometer Experiment Derived Product:hp3_rad_der_00014_20181211_073042"
...
```

Open Data

NOT IMPLEMENTED

See [<u>https://project-open-data.cio.gov/</u>](https://project-open-data.cio.gov/) and example of application at [<u>https://cmr.earthdata.nasa.gov/search/site/docs/search/api.html#open-data</u>](https://cmr.earthdata.nasa.gov/search/site/docs/search/api.html#open-data)

2.3.3 Missing values

Properties with empty or null values should be dropped from the JSON response unless the user asked specifically for the field (through *field* API parameter). In this case the value must be **null**, without quotes.

Rationale

If a property is optional or has an empty or null value, consider dropping the property from the JSON, unless there's a strong semantic reason for its existence (taken from this discussion)

Following interactions with OGC/EDR specification group: https://github.com/opengeospatial/ogcapi-environmental-data-retrieval/issues/171#issuecomment-767805902

We choose **null** without quotes for missing values of fields explicitly requested by the user.

We conform to EDR specification for this aspect, see [http://docs.opengeospatial.org/DRAFTS/19-086.html#req_edr_parameters-response</u>](http://docs.opengeospatial.org/DRAFTS/19-086.html#req_edr_parameters-response)

This should not be mistaken for an actual PDS4 value since missing values in PDS4 labels. are detailed with a nil:reason attribute.

2.4 Tutorials/Cookbooks

2.4.1 Sample JupyterLab Notebooks (Python)

The following Git repository contains example JupyterLab notebooks for the application programmer's interface (API) of the Planetary Data System, that can be used as a tutorial to work with the PDS Search API.

https://github.com/NASA-PDS/pds-api-notebook/

2.4.2 Web Search Interface Tutorial (HTML/Javascript)

TO BE IMPLEMENTED

2.4.3 Search Examples

See the Search API Cookbook for more details.

CHAPTER

THREE

SPECIFICATIONS

Each published version of NASA PDS APIs is documented here:

- Search API v0.4.1
- Search API v1.0.0-SNAPSHOT
- DOI API v0.2

More details and rationale for the design can be found in the general conventions and the *search API user's guide*.

CHAPTER

FOUR

TOOLS AND SERVICES

4.1 Search

- Server: https://github.com/NASA-PDS/registry-api
- Client: https://github.com/NASA-PDS/pds-api-client

4.2 DOI

- Server: https://github.com/NASA-PDS/doi-service/
- Client (DOI Editor Web App): https://github.com/NASA-PDS/doi-ui/
- Client (DOI Search Web App): https://github.com/NASA-PDS/wds-react

CHAPTER

FIVE

SUPPORT

5.1 Contact Us

Feel free to contact us the PDS Operator for any additional questions, comments or concerns.

5.2 Contribute

We are always looking for community input into our software. Feel free to contribute to the PDS repos:

- Contribute to this documentation: https://github.com/NASA-PDS/NASA-PDS.github.io
- Contribute to a specific software project: https://github.com/NASA-PDS

5.3 Request a New Tool / Service

Feel free to propose a new idea to our Engineering Node Operations repo and we will triage it appropriately.

5.4 Report a Bug

To report a bug found in either a software tool or services, report in the individual repo for the project, or in our Engineering Node Operations repo and we will triage it appropriately.

CHAPTER

SIX

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6.1 PDS API Working Group

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