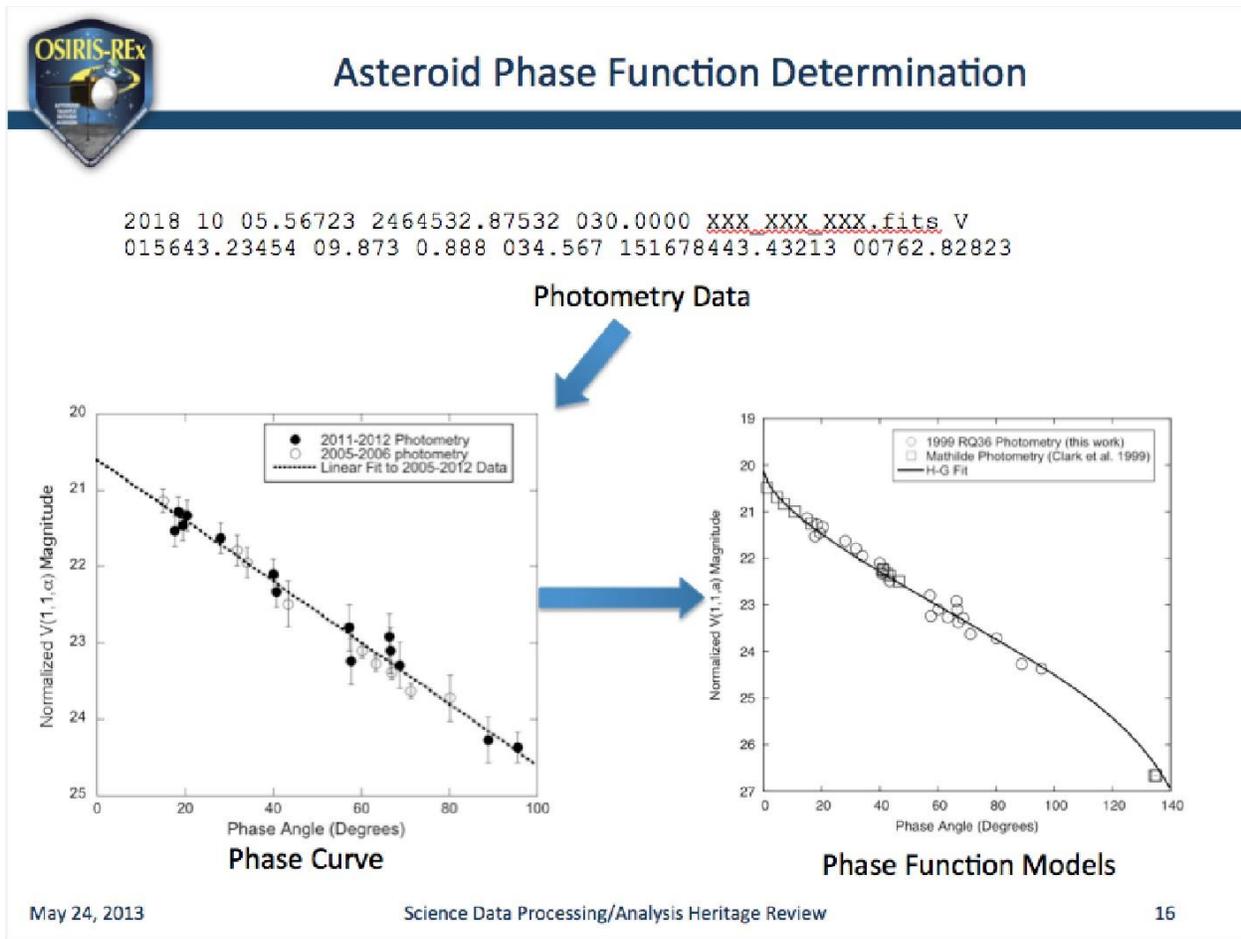


MRD 158- Asteroid Phase Functions

Data Product Overview

One sentence executive description of product

Asteroid phase function data product is a model of the light scattering behavior of the asteroid's surface at varying phase angles (Sun-asteroid-s/c angle).



Overview

Data type (image, spectrum, data table, map format etc.)

data table

What does it measure at what scale

unresolved/point source

What observations are required to provide the input data needed to make the data product?

MapCam images taken in all four ECAS filters

When in the DRM are the observations that make the data product scheduled to be taken?

during the Approach Phase

How long does it take to produce the data product?

observations to be taken over a duration of 3 days

Is this product used of sample site selection, science value, or long-term science?

long-term science

Data Product Structure and Organization

What is the structure of the data product (e.g. FITS file with 4 extensions)

ASCII

How is the product organized (e.g. one data set per mission phase, one file per Earth Day, etc.)

two files (one contains all phase function photometry, the other contains all phase function model solutions)

Data Format Descriptions

Header information (metadata) included with data product. For example:

Header for phase function photometry

ASCII table including the following for the lightcurve photometry file: mid-point of observation (UT), exposure length, filter, photometric flux, magnitude, rotation phase, lightcurve photometric correction, phase angle, OREx-Sun distance, OREx-satellite distance

Header for phase function model parameters

filter, linear fit absolute magnitude, linear fit slope, IAU H-G H parameter, IAU H-G G parameter

Detailed Description of data format. For example:

Table

Data Type

ASCII

Field name, Field Description, Field Length, Field Format

for phase function photometry:

ASCII table including the following for the lightcurve photometry file: year of mid-point of observation (UT), month of mid-point of observation (UT), decimal day of mid-point of observation (UT), exposure length, filter, photometric flux, apparent magnitude, absolute magnitude normalized distances of 1 AU between the Bennu and Sun and Bennu and spacecraft, rotation phase, lightcurve photometric correction, phase angle, OREx-Sun distance, OREx-Bennu distance

for phase function model solutions:

filter, linear fit absolute magnitude, linear fit slope, IAU H-G H parameter, IAU H-G G parameter

example of phase function photometry format:

```
2018 10 11.123456 100.000 b 123456 10.123 20.123 0.1234 -0.123 123.456
0.12345 123456.123
```

example of phase function photometry FORTRAN format:

```
I4,1X,I2,1X,F9.6,1X,F7.3,1X,A1,1X,I6,1X,F6.3,1X,F6.3,1X,F6.4,1X,F6.3,1X,
F7.3,1X,F7.5,1X,F10.3
```

example of phase function model parameters format:

```
x 20.567 +0.034 20.678 +0.123
```

example of phase function model parameters FORTRAN format:

```
A1,1X,F6.3,1X,F6.3,1X,F6.3,1X,F6.3
```

Data Product Generation

How and by whom is the product generated?

What are the input products needed to produce the product?

MapCam images of Bennu, MapCam photometric calibrations, photometric star catalogs, s/c ephemeris position, Bennu ephemeris position, MapCam image filter, MapCam image exposure time, MapCam image exposure duration

Are there format expectations for the input products?

Yes. MapCam image headers need to use the standard FITS header format. A list of FITS keywords and their meanings is required for reading these values into the photometry software.

What algorithms and/or calibration data is used to generate products?

Are there format expectations for the inputs?

Has a specific Science Team Member been assigned to produce this product?

Carl Hergenrother

Will multiple versions of the product be generated?

No

How will they differ?

On what cadence will they be delivered?

N/A

Data Product Validation

How will the product be vetted to ensure contents and format are correct?

Software to be tested on real ground-based phase function data of asteroids analogous to Bennu. Analogous asteroids will have “well determined” phase function parameters.

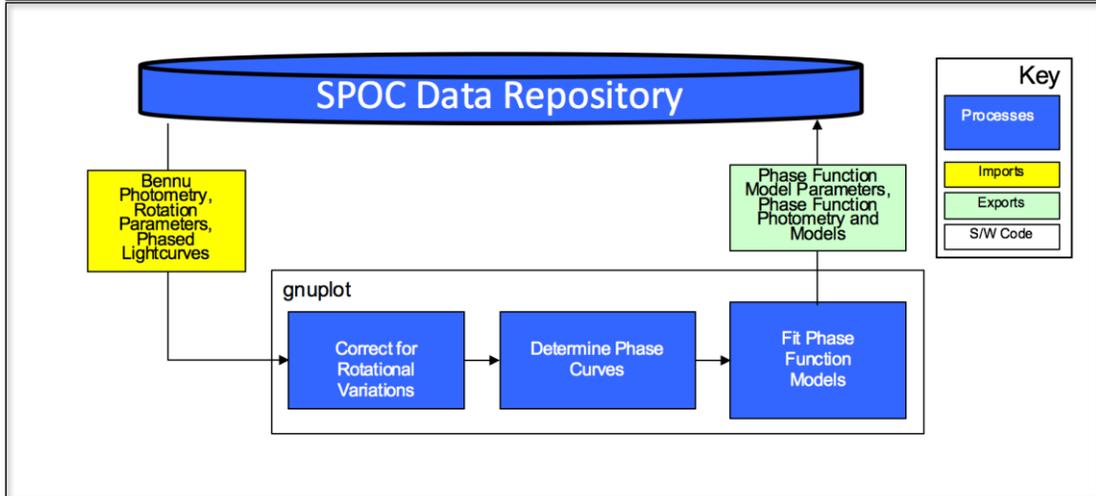
Data Flow

Update Data flow diagrams with more detailed based on current processing configuration.



Phase Function Determination

- List functions of Phase Function Determination:
1. Retrieve list of phase function photometry, rotation period and phased lightcurves from SPOC Data Repository
 2. Correct phase function photometry for brightness variations due to the rotation of the object
 3. Determine the phase curve
 4. Fit phase function models
 5. Archive phase function curves, models and parameters to SPOC Data Repository



Describe the sources, destinations, and transfer procedures for data products.

State the size of an individual data product and the total size of all the data products generated over the course of each mission phase. Size estimate by Baseline?

All data produced during the Approach phase.

Data products are relatively small ASCII text files (<< 1MB).

State the time span covered by a product, if applicable, and the rate at which products are generated and delivered.

Data product covers observations taken throughout the Approach phase.

Standards used to generate data product

Time (e.g. times are all converted to UTC)

UTC

Coordinate System

astronomical photometric system (b,v,w,x,monochrome v)

Data Storage Conventions (i.e. byte order, compression, machine dependence)

Product to be retrieved via WebQuery based on data product type (name) or date observation was made. For example, I do not foresee a request to download one photometric point but do foresee downloading all photometry taken on a single date.

Relevant ICD Data Products:

- Phase Function Photometry Models (AP-14)
- Phase Function Model Parameters (AP-15)
- Bennu Point Spread Function (AP-19)