Deliverable D2.3

H2020 COMPET-05-2015 project "Small Bodies: Near And Far (SBNAF)"

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Lead Author	Kiss, C; MTA CSFK (kiss.csaba@csfk.mta.hu)
Co-authors	T. Müller, A. Farkas-Takács

Objectives of the WP: To produce expert-reduced Herschel data of primary focus targets: (a) of large TNOs (photometric and lightcurve observations); (b) MBAs (science and calibration observations); (c) dedicated NEA observations. To collect auxiliary infrared data from previous missions (Spitzer, Planck, WISE, Akari, IRAS, ISO, MSX) and published ground-based mid-IR, submm, millimetre observations and to prepare data for integration in a unique database. To create a database of infrared observations of all SBNAF targets (TNOs, MBAs, NEAs) with the option for extension to larger object samples.

Goal of the deliverable D2.3:

The immediate goal of this delivery (D2.3) is to provide the science community with expert reduced data products of Herschel main-belt asteroid observations. The D2.3-related new products are uploaded to and accessible through the Herschel Science Archive (*http://www.cosmos.esa.int/web/herschel/science-archive*).

Contents

1 Introduction

One of the goals of WP2 Infrared observations is to produce a set of high-quality data products for Herschel observations of Solar System objects for an upload to the Herschel Science Archive (HSA). These new products will then be available for the entire scientific community, in parallel to the standard pipeline-processed Herschel archive data. In the deliverable D2.1 we focused on the general processing tools and scripts for these Herschel Solar System observations and pointed out differences to the standard pipeline processing. In D2.2 we produced expert-reduced/calibrated and object-centered images for all Herschel-PACS photometer observations of near-Earth asteroids (NEA). These new products are available from the HSA (as User-Provided Data Products UPDP) together with a dedicated release note.

The focus of D2.3 is on Herschel measurements of main-belt asteroids (MBA). Almost all of these measurements are part of the PACS calibration programmes and only very few are related to dedicated science projects (see Section 2.3 and Tables 3 and 4). Most of these calibration measurements, as well as all the science measurements, are taken in the standard PacsPhoto observing modes. For SSO-tracked measurements the processing was done in the object's co-moving reference frame. The MBAs are typically bright and even the shortest measurements produce very high signal-to-noise ratios. In general, the default pipeline processing worked out very well and produced reliable products in the HSA.

It is also important to note here that the PACS photometer flux calibration is based on repeated measurements of 5 fiducial stars (see Balog et al. 2014), and the absolute flux calibration of the derived final asteroid images are tied to these stellar models (Decin & Eriksson 2007; Dehaes et al. 2011). Therefore, the asteroid HSA products are absolutely calibrated and scientifically useful.

For most of the scientific applications it would be possible to take the single-epoch, single-band, and well-calibrated images directly from the HSA (pipeline-processed Level-2 products, produced by standard high-pass filter procedures). The automatically displayed Level-2.5 products (JScanam processed; Graciá-Carpio et al. 2015) are less useful: they combine data from different measurements and asteroid rotational flux changes are averaged.

We produced new images only for the cases where the pipeline processing failed, for fainter asteroids, and for specific cases where the pipeline produced suboptimal results. The data processing and calibration steps are discussed in Section 3 and the final products are described in Section 4. We provided the new MBA images to the Herschel Science Center (HSC) for an upload to the HSA as User-Provided Data Products (UPDP). The delivery of products (FITS images) for the HSA came also with a product-specific release note: http://www.cosmos.esa.int/web/herschel/user-provided-data-products These UPDP are publicly available from the HSA for all registered users.

In parallel to D2.3 (and D2.2), we prepare an A&A catalog paper which contains all NEA and MBA flux densities derived from the final PacsPhoto images. In the publication we explain in more details the methods to derive fluxes and error bars, but we also discuss quality issues (where applicable), and we show the high scientific potential of these measurements.

2 Herschel MBA Observations

2.1 Herschel Space Observatory

The Herschel Space Observatory (short: Herschel; Pilbratt et al. 2010) was operational from 2009 until 2013. It had three instruments on board: The Photodetector Array Camera and Spectrometer

(PACS) instrument (Poglitsch et al. 2010), the Spectral and Photometric Imaging Receiver (SPIRE; Griffin et al. 2010), and the Heterodyne Instrument for the Far Infrared (HIFI; de Graauw et al. 2010). All three instruments were used to observe Solar System objects in different photometry and spectroscopy observing modes. The observations cover scientific, as well as calibration measurements. Most of these data are taken in tracking mode, a few also in fixed mode. All Herschel measurements taken in validated observing modes, were pipeline processed in a default way and are available from the HSA. More details about the observations, data reduction, calibration, and HSA data products can be found on the web pages of the Herschel Science Center (HSC) at: https://www.cosmos.esa.int/web/herschel.

2.2 PACS Photometer

The PACS photometer (PacsPhoto) had two main observing modes: a chop-nod observing technique and a scan-map mode. Both modes were used extensively for the observations of MBAs. Details of these modes, their calibration, details on the performance, and a discussion of the modes can be found in Balog et al. (2014) for the scan-map technique and in Nielbock et al. (2013; 2014) for the chop-nod mode. Kiss et al. (2014) discussed the reduction and calibration procedures for PacsPhoto observations of faint SSOs. Müller et al. (2016) looked at the performance of the two PacsPhoto sub-modes in the context of bright SSO (outer planets and satellites). Müller et al. (2014) presented already PacsPhoto observations taken in both modes on the four asteroids 1 Ceres, 2 Pallas, 4 Vesta, and 21 Lutetia.

2.3 PacsPhoto MBA observations

The PacsPhoto observations of MBAs are listed in all details in the Appendix: Table 3 for the chop-nod measurements and Table 4 for the scan-map observations. The PACS Photometer chop-nod observations were mainly taken with dither option and in high gain, typically in single repetition and SSO tracking mode. The scan-map data are mainly taken in "largeScan" mode (with 20″/sec satellite scan speed and usually in either 70°or 110° scan angle in the instrument reference frame), in "high gain" detector setting, and in SSO tracking mode. Deviations from the default settings and more details about map parameters are given in the two above mentioned tables. For most of the targets all three filters (blue = 70 μm, green = 100 μm, red = 160 μm) were used. In addition to the instrument-specific settings for the modes, we also give the observational day (OD), observation identifier (OBSID), and spacecraft-specific solar-aspect angle (SAA), satellite scan speed and scan angles in these tables. The data are related to the following calibration[1] and science programmes:

- Calibration_coppacs_##: calibration programme in the Herschel Commissioning Phase
- Calibration_pvpacs_##: calibration programme in the Herschel Performance Verification Phase
- Calibration_rppacs_###: calibration programme in the Herschel Routine Calibration Phase
- DDT_dbockele_3: "Origin of water outgassing from asteroid CERES" (PI: Dominique Bockelee-Morvan, 2.2 hours)

[1] http://herschel.esac.esa.int/twiki/pub/HSC/PACSLevel1/PCDissue1p10_PACS-MA-GS-001.pdf

- GT1_lorourke_9: "Herschel In-situ Asteroid & Comet Observation programme" (PI: Laurence O'Rourke, 20.3 hours)
- DDT_fhormuth_1: "ToO suggestion: last light for Herschel" (PI: Felix Hormuth, 0.2 hours)

The PacsPhoto MBA target list comprises: **1 Ceres, 2 Pallas, 3 Juno, 4 Vesta, 6 Hebe, 8 Flora, 10 Hygiea, 18 Melpomene, 19 Fortuna, 20 Massalia, 21 Lutetia, 29 Amphitrite, 47 Aglaja, 52 Europa, 54 Alexandra, 65 Cybele, 88 Thisbe, 93 Minerva, 253 Mathilde, 360 Carlova, 423 Diotima, 511 Davida, 704 Interamnia, 2000 Herschel, and 2867 Šteins.**

3 Data reduction, calibration and quality

3.1 Standard pipeline-processed HSA products

The standard PacsPhoto pipeline processing worked fine for almost all bright MBA chop-nod and scan-map measurements (exceptions: see Section 4). For each OBSID one can simply take the level-2 products from the HSA: HPPPMAPB (blue/green channel) & HPPPMAPR (red channel), both in Jy/pixel. The acronym stands for "Herschel Pacs Photometer PhotProject MAP Blue/Red". It refers to maps produced by the photProject task, i.e. a simple projection of each frame (10Hz), after running a temporal high-pass filter with a width of n=20 (i.e subtracting a median with a width of 2*n+1 frames). This allows to filter a signicant part of the 1/f noise at the expense of removing completely **all** spatial scales larger than this width (i.e. typically larger than 1 arcmin). This processing is mostly targeted to detect point-sources with good sensitivity (see PACS Observer's Manual[2]). The calibration of these products is based on repeated observations of five fiducial stars (see Balog et al. 2014). These stars have high-quality model predictions in the PACS wavelength range and allowed to establish a 5% absolute calibration accuarcy of all PacsPhoto maps (Balog et al. 2014; Nielbock et al. 2013, 2014). The very high reproducibility of fluxes throughout the entire Herschel mission can be seen on these measurements of the stellar calibrators, but also on the monitoring of the detector response via short calibration block sequences (chopping between two PACS-internal calibration sources at the start of each OBSID). Moor et al. (2014) showed that the peak-to-peak detector response variation during the almost 1500 days of the mission was only about 2% in the blue channel, 3% in the green channel, and 5% in the red channel, below or comparable to the established absolute flux calibration error of 5%. More details about the detector response, measurement and absolute flux errors will be given in paper about the PacsPhoto NEA/MBA fluxes (Müller, Kiss et al., in preparation).

3.2 Data reduction and calibration

The PACS photometer data reduction optimized for moving Solar System objects is described in Kiss et al. 2014: "Optimized Herschel/PACS photometer observing and data reduction strategies for moving solar system targets" (https://arxiv.org/abs/1309.4212), with updates documented in SBNAF Deliverable "D2.1 Herschel tools" from September 30, 2016. Specific procedures were applied to produce the new products listed in Sec. 4.

For targets whose data can be reduced in a fixed frame and have overlapping backgrounds at different epochs differential and double-differential products can be produced (DIFF and DDIFF, see the D2.1 documentation). However, for MBAs the apparent velocities are typically too high

[2] `http://herschel.esac.esa.int/Docs/PACS/html/pacs_om.html`

for these kind of products and for most targets the reduction had to be performed in the co-moving frame using a specific motion correction (dubbed as 'SSO' in the respective tables). In addition, selection of repetitions and/or scan legs and stacking of multiple images were necessary in most cases as described in the target-specific subsections below, and also in the summary tables in the Appendix. A special case was the measurements of 4 Vesta during a close αTau encounter which was not taken in the standard SSO tracking mode, but in the fixed celestial frame. More details on these specific measurements can be found in Müller et al. 2014, and also in Sect. 4.

As mentioned in Section 3.1, with the exception of the cases detailed in Sect. 4 all Level-2 MBA data products in the HSA can be used for scientific purposes.

3.3 Quality

As part of D2.3 we also looked into quality aspects for our list of MBA PacsPhoto observations. In general, only very few measurements are affected by satellite or instrument events:

- A few observations have pointing-critical solar aspect angles (SAA) of the spacecraft below -20° (Sánchez-Portal et al. 2014). The astrometry of the Šteins and a few Hygiea measurements might therefore be less reliable (see entries SAA in Tbl. 4).
- Some of the MBA observations were executed either with 10″/s or 60″/s scan speed (see Table 4). Photometry using small apertures is therefore not recommended due to the slightly different PSF shapes (see entries "S" in Tbl. 4).
- The long multi-repetition chop-nod measurements of Flora and Melpomene were problematic in the standard pipeline reduction for unknown reasons (see below).
- The αTau-Vesta measurements are taken in fixed mode (see below).
- The standard pipeline processing for faint SSOs has very limited quality (see below).
- The observations of the MBA 2000 Herschel (OD 1442) failed due to a detector temperature rise (followed by PACS SAFE mode) caused by a shorter-than-normal cooler cycle.
- On OD 1375 (February 17, 2013) half of the red PACS photometer array was lost. Later measurements have therefore lower coverage in the red channel, but standard processing and photometry are still reliable.
- The bolometer detector bias settings were fixed starting from OD132 (SCR[3] PACS-2038, adjustment of dynamic range, MC P22). Measurements taken ealier have slightly different bias settings and the flux calibration might be less reliable (can be verified via dedicated measurements on the internal calibration sources, see also CalBlock database[4] and Moor et al. 2014).
- The detector setup procedure was fixed from OD 171 onwards. Measurements taken before could suffer (in extreme cases) by a slightly drifting detector response in the beginning of the measurements, but the so-called T_ev correction (automatically done in the processing) was introduced to correct for the effect (see also Moor et al. 2014).

[3] Software Change Request
[4] http://pacs.ster.kuleuven.be/pacstrend/LongTerm/calBlocksTrend.html

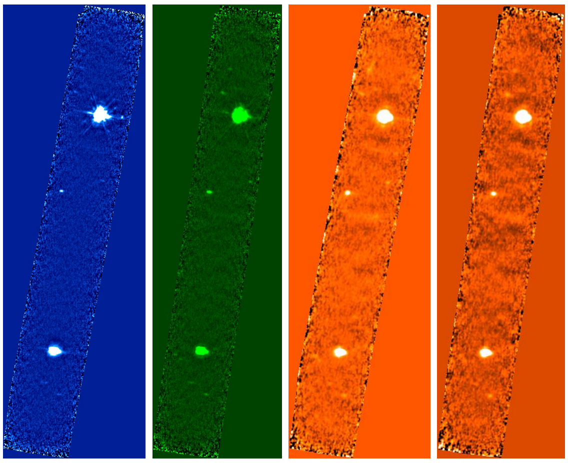

Figure 1: Image stamps of the newly processed observations of αTau-Vesta at 70 μm (blue), 100 μm (green), and twice 160 μm (red). Images are centered on Vesta (upper bright source). The middle source in all images is the galaxy SSTSL2 J043553.24+163919.8, the lower bright source is αTau.

- We are not aware of PacsPhoto measurement problems related to space weather. The Herschel onboard SREM instrument data are available and solar flare effects were noted in a few PacsSpec measurements, but never in PacsPhoto data.
- We also checked all PacsPhoto MBA measurements against the HSC lists of special events and anomalies, but (except for the 2000 Herschel measurements) our measurements were not affected.

4 Description of new MBA products

4.1 αTau-Vesta measurements

The measurements on αTau-Vesta were taken in a fixed sky position which was pre-calculated and located in the middle between both objects. The default archive products show images with αTau being perfectly point-like, but Vesta is elongated, i.e. reduced in the fixed celestial frame. For producing reliable products also for Vesta, the processing was repeated, but now in Vesta's co-moving reference system (see Fig. 1). Now, Vesta looks perfectly point-like (and can be used for standard aperture photometry) while αTau is elongated. More details on these specific measurements can be found in Müller et al. 2014. The new FITS files (1 blue, 1 green, 2 reds) and the corresponding stamp images are provided as UPDP to the HSA.

A similar set of products was produced for measurements on the close encounter between Callisto and Ganymede (see Müller et al. 2016) where both targets were moving with different apparent motions and in different directions.

4.2 Multi-repetition chop-nod measurements

Modifications in the standard chop-nod script were necessary to process the multi-repetition measurements of 8 Flora (OD 101) and 18 Melpomene (OD 41). The automatic pipeline processing did

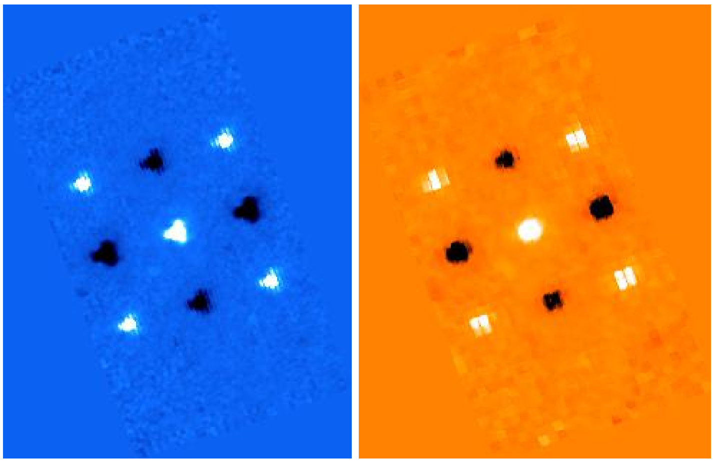

Figure 2: Image stamps of the newly processed observations of 8 Flora at 70 μm (blue), and twice 160 μm (red). Only the first block with about 0.1 h integration time is shown. Due to the chop-nod mode, the source appears nine times: five times as possitive source, four times as negative source. Photometry can be done on the central source.

not work here.

8 Flora: The 8 Flora measurement from OD101 was conducted with 30 repetition in chop-nod mode (low gain, blue/red filter combination, dithering). The total integration time was about 1.4 hours (rotation period is about 12.5 hours). During the processing, the measurement was split into 15 blocks, each including a full nodA-nodB-nodB-nodA sequence. Each block resulted then in a pair of 70 & 160 μm images which can be used for extracting the photometry. Fig. 2 shows the final images of the first block.

The 30 new FITS files (15 for the blue channel, 15 for the red) are delivered as UPDP to the HSA.

18 Melpomene: The 18 Melpomene measurement from OD41 was conducted with 20 repetition in chop-nod mode (low gain, blue/red filter combination, dithering). The total integration time was about 1.0 hour (rotation period is about 11.6 hours). During the processing, the measurement was split into 10 blocks, each including a full nodA-nodB-nodB-nodA sequence. Each block resulted then in a pair of 70 & 160 μm images which can be used for extracting the photometry. Fig. 3 shows the final images of the first block.

The 20 new FITS files (10 for the blue channel, 10 for the red) are delivered as UPDP to the HSA.

4.3 Faint MBA 2867 Šteins

The Rosetta fly-by target and MBA 2867 Šteins was part of the science programme GT1_lorourke_9 "Herschel In-situ Asteroid & Comet Observation programme" (PI: L. O'Rourke). The minor planet Šteins was too faint for automated photometry. The new data products are based on optimized SSO

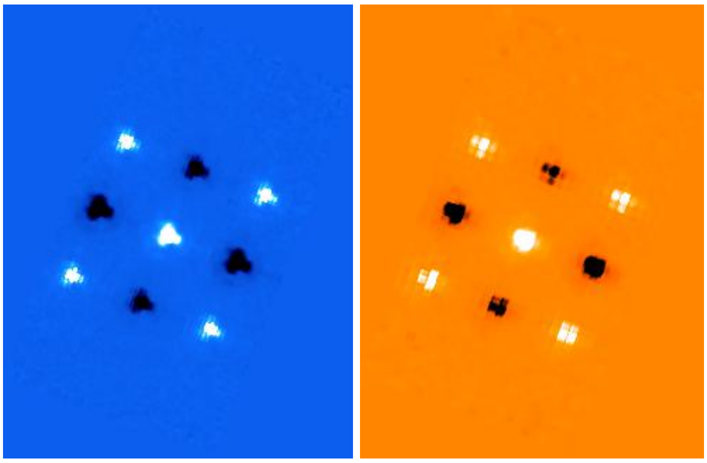

Figure 3: Image stamps of the newly processed observations of 18 Melpomene at 70 μm (blue), and twice 160 μm (red). Only the first block with about 0.1 h integration time is shown.

reduction procedures for SSOs (Kiss et al. 2014). The background has a very high level of confusion noise (see Fig. 4) and influences severely the final photometry.

The 3 new FITS files (1 for the blue channel, 1 for green, and 1 for the red) are delivered as UPDP to the HSA.

References

- Balog, Z., Müller, T.G., Nielbock, M., et al., 2014, The Herschel-PACS photometer calibration: Point-source flux calibration for scan maps, Experimental Astronomy, 37, 129
- Decin, L. & Erikson, K. 2007, Theoretical model atmosphere spectra used for the calibration of infrared instruments, A&A 472, 1041
- de Graauw, Th., Helmich, F. P., Phillips, T. G. et al. 2010, The Herschel-Heterodyne Instrument for the Far-Infrared (HIFI), A&A, 518, 6
- Dehaes, S. et al. 2011, Structure of the outer layers of cool standard stars, A&A 533, 107
- Graciá-Carpio, J., Wetzstein, M. & Roussel, H. 2015, The JScanam Map-Maker Method Applied to Herschel/PACS Photometer Observations, proceedings of ADASS XXV; to be published in ASP Conf. Ser. (2016), Lorente, N. P. F. and Shortridge, K., Eds, (arXiv:1512.03252v1)
- Griffin, M. J., Abergel, A., Abreu, A. et al. 2010, The Herschel-SPIRE instrument and its in-flight performance, A&A, 518, 3G
- Kiss, C.; Müller, T. G.; Vilenius, E.; et al., 2014, Optimized Herschel/PACS Photometer observing and data reduction strategies for moving solar system targets, Experimental Astronomy, 37, 161
- Moór, A., Müller, T. G., Kiss, C. et al., 2014, PACS photometer calibration block analysis, Experimental Astronomy, 37, 225

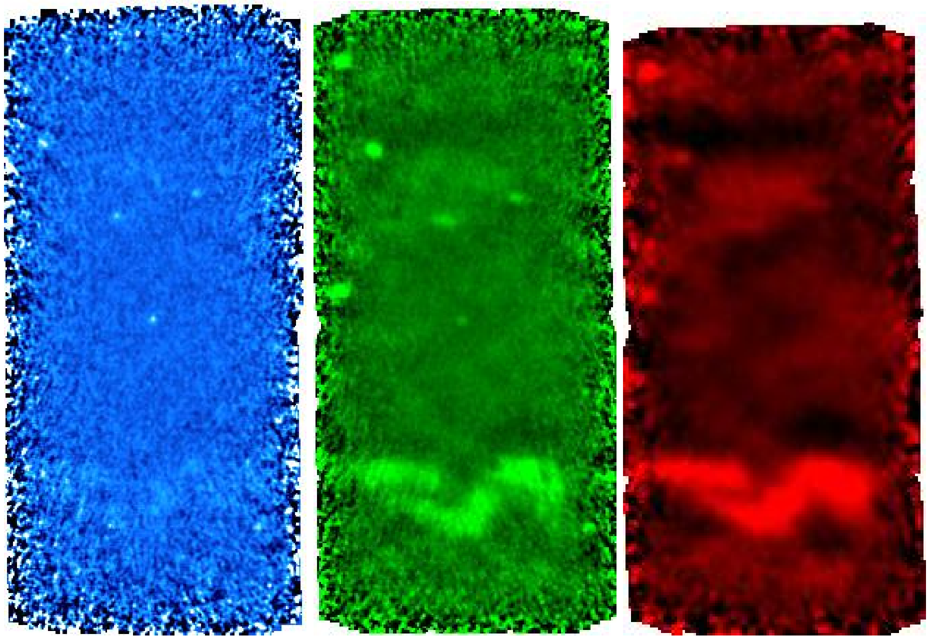

Figure 4: Image stamps of the newly processed observations of 2867 Šteins at 70 μm (blue), 100 μm (green), and 160 μm (red). The asteroid is the faint point source in the center, nicely visible in the blue and green band, but not in the red band.

- Müller, T.G.; Balog, Z., Nielbock, M., et al., 2014, Herschel celestial calibration sources: Four large main-belt asteroids as prime flux calibrators for the far-IR/sub-mm range, Experimental Astronomy, 37, 253
- Müller, T.G., Balog, Z., Nielbock, M., et al., 2016, Far-infrared photometric observations of the outer planets and satellites with Herschel-PACS, A&A, 588, 109
- Nielbock, M., Müller, T.; Klaas, U., et al., 2013, The Herschel-PACS photometer calibration: A time dependent flux calibration for the PACS chopped photometry AOT mode, Experimental Astronomy, 36, 631
- Nielbock, M., Müller, T.; Klaas, U., et al., 2014, Publisher's Erratum to: The Herschel-PACS photometer calibration: A time dependent flux calibration for the PACS chopped photometry AOT mode, Experimental Astronomy, 37, 127
- Pilbratt, G. L., Riedinger, J. R., Passvogel, T. et al. 2010, Herschel Space Observatory. An ESA facility for far-infrared and submillimetre astronomy, A&A, 518, L1
- Poglitsch, A., Waelkens, C., Geis, N. et al. 2010, The Photodetector Array Camera and Spectrometer (PACS) on the Herschel Space Observatory, A&A, 518, L2
- Sánchez-Portal, M., Marston, A., Altieri, B. et al. 2014, The pointing system of the Herschel space observatory: Description, Calibration, Performance and improvements, Experimental Astronomy, 37, 453

Appendix

Summary of uploaded data products

Target		Band	Filename	OBSID(s)	Type
4	Vesta	70	map_4_Vesta_sso_1342249092_70	1342249092	SSO /Stacked
4	Vesta	100	map_4_Vesta_sso_1342249093_100	1342249093	SSO /Stacked
4	Vesta	160	map_4_Vesta_sso_1342249092_160	1342249092	SSO /Stacked
4	Vesta	160	map_4_Vesta_sso_1342249093_160	1342249093	SSO /Stacked
8	Flora	70	map_8_Flora_sso_1342182740_70_rep0	1342182740	SSO rep 0
8	Flora	70	map_8_Flora_sso_1342182740_70_rep1	1342182740	SSO rep 1
8	Flora	70	map_8_Flora_sso_1342182740_70_rep2	1342182740	SSO rep 2
8	Flora	70	map_8_Flora_sso_1342182740_70_rep3	1342182740	SSO rep 3
8	Flora	70	map_8_Flora_sso_1342182740_70_rep4	1342182740	SSO rep 4
8	Flora	70	map_8_Flora_sso_1342182740_70_rep5	1342182740	SSO rep 5
8	Flora	70	map_8_Flora_sso_1342182740_70_rep6	1342182740	SSO rep 6
8	Flora	70	map_8_Flora_sso_1342182740_70_rep7	1342182740	SSO rep 7
8	Flora	70	map_8_Flora_sso_1342182740_70_rep8	1342182740	SSO rep 8
8	Flora	70	map_8_Flora_sso_1342182740_70_rep9	1342182740	SSO rep 9
8	Flora	70	map_8_Flora_sso_1342182740_70_rep10	1342182740	SSO rep 10
8	Flora	70	map_8_Flora_sso_1342182740_70_rep11	1342182740	SSO rep 11
8	Flora	70	map_8_Flora_sso_1342182740_70_rep12	1342182740	SSO rep 12
8	Flora	70	map_8_Flora_sso_1342182740_70_rep13	1342182740	SSO rep 13
8	Flora	70	map_8_Flora_sso_1342182740_70_rep14	1342182740	SSO rep 14
8	Flora	160	map_8_Flora_sso_1342182740_160_rep0	1342182740	SSO rep 0
8	Flora	160	map_8_Flora_sso_1342182740_160_rep1	1342182740	SSO rep 1
8	Flora	160	map_8_Flora_sso_1342182740_160_rep2	1342182740	SSO rep 2
8	Flora	160	map_8_Flora_sso_1342182740_160_rep3	1342182740	SSO rep 3
8	Flora	160	map_8_Flora_sso_1342182740_160_rep4	1342182740	SSO rep 4
8	Flora	160	map_8_Flora_sso_1342182740_160_rep5	1342182740	SSO rep 5
8	Flora	160	map_8_Flora_sso_1342182740_160_rep6	1342182740	SSO rep 6
8	Flora	160	map_8_Flora_sso_1342182740_160_rep7	1342182740	SSO rep 7
8	Flora	160	map_8_Flora_sso_1342182740_160_rep8	1342182740	SSO rep 8
8	Flora	160	map_8_Flora_sso_1342182740_160_rep9	1342182740	SSO rep 9
8	Flora	160	map_8_Flora_sso_1342182740_160_rep10	1342182740	SSO rep 10
8	Flora	160	map_8_Flora_sso_1342182740_160_rep11	1342182740	SSO rep 11
8	Flora	160	map_8_Flora_sso_1342182740_160_rep12	1342182740	SSO rep 12
8	Flora	160	map_8_Flora_sso_1342182740_160_rep13	1342182740	SSO rep 13
8	Flora	160	map_8_Flora_sso_1342182740_160_rep14	1342182740	SSO rep 14
18	Melpomene	70	map_18_Melpomene_sso_1342179011_70_rep0	1342179011	SSO rep 0
18	Melpomene	70	map_18_Melpomene_sso_1342179011_70_rep1	1342179011	SSO rep 1
18	Melpomene	70	map_18_Melpomene_sso_1342179011_70_rep2	1342179011	SSO rep 2
18	Melpomene	70	map_18_Melpomene_sso_1342179011_70_rep3	1342179011	SSO rep 3
18	Melpomene	70	map_18_Melpomene_sso_1342179011_70_rep4	1342179011	SSO rep 4
18	Melpomene	70	map_18_Melpomene_sso_1342179011_70_rep5	1342179011	SSO rep 5
18	Melpomene	70	map_18_Melpomene_sso_1342179011_70_rep6	1342179011	SSO rep 6
18	Melpomene	70	map_18_Melpomene_sso_1342179011_70_rep7	1342179011	SSO rep 7
18	Melpomene	70	map_18_Melpomene_sso_1342179011_70_rep8	1342179011	SSO rep 8
18	Melpomene	70	map_18_Melpomene_sso_1342179011_70_rep9	1342179011	SSO rep 9
18	Melpomene	160	map_18_Melpomene_sso_1342179011_160_rep0	1342179011	SSO rep 0
18	Melpomene	160	map_18_Melpomene_sso_1342179011_160_rep1	1342179011	SSO rep 1
18	Melpomene	160	map_18_Melpomene_sso_1342179011_160_rep2	1342179011	SSO rep 2
18	Melpomene	160	map_18_Melpomene_sso_1342179011_160_rep3	1342179011	SSO rep 3
18	Melpomene	160	map_18_Melpomene_sso_1342179011_160_rep4	1342179011	SSO rep 4
18	Melpomene	160	map_18_Melpomene_sso_1342179011_160_rep5	1342179011	SSO rep 5
18	Melpomene	160	map_18_Melpomene_sso_1342179011_160_rep6	1342179011	SSO rep 6
18	Melpomene	160	map_18_Melpomene_sso_1342179011_160_rep7	1342179011	SSO rep 7
18	Melpomene	160	map_18_Melpomene_sso_1342179011_160_rep8	1342179011	SSO rep 8
18	Melpomene	160	map_18_Melpomene_sso_1342179011_160_rep9	1342179011	SSO rep 9
2867	Steins	70	map_2867_Steins_sso_70	1342250354/55	SSO /Stacked
2867	Steins	100	map_2867_Steins_sso_100	1342250356/57	SSO /Stacked
2867	Steins	160	map_2867_Steins_sso_160	1342250354/55/56/57	SSO /Stacked

Table 1: List of data products uploaded to the Herschel Science Archive for the asteroids 4 Vesta, 8 Flora, 18 Melpomene, and 2867 Steins, related to the deliverable D2.3. The columns of the table are (1) Target; (2) wavelength (μm); (3) file name; (4) OBSID(s) used; (5) product type. See the main text for a detailed description of the data products.

Summary of additional FITS keywords

OBS_ID	Herschel observation identifier number / single observation used for data product
OBSID001, OBSID002, ... OBSIDnnn	Herschel observation identifier number / multiple observations used for data product
OBSDAY	Herschel operational day / single observation used for data product
OBSDAY01, OBSDAY02, ... OBSDAYnn	Herschel operational day / multiple observations used for data product
PROPOSAL	Herschel proposal ID of the observations used
LAYER0, LAYER1	Type of data in a specific data layer of the FITS cube ("image" or "coverage")
EQLEVEL	Equivalent level of SPG processing
TARGET	Name or designation of the target
INSTRUME	Main Herschel instrument
SUBINSTR	Subinstrument
FILTER	Nominal wavelength of the filter used (mircometer)
DATAPRID	Type of data product
PROJECT	Project identifier
LEGS	Legs used for data product generation
REPETIT1, REPETIT2, ..., REPETITn	Repetition(s) used from the respective OBSID(s)

Table 2: List of keywords added to the header of the data product FITS files. Note that not all keywords apply to a specific data product type.

Chop-nod observations

Table 3: Herschel-PACS photometer **chop-nod observations of asteroids** (proposals Calibration_coppacs_##, Calibration_pvpacs_## and Calibration_rppacs_###), all taken in point-source observing mode, and solar system object (SSO) tracking mode. SAA: solar aspect angle; dur.: duration of observation in seconds; fil: filter/band combination (B/R: 70/160 μm; G/R: 100/160 μm); D: dither yes(Y)/no(N); G: low (L) or high (H) gain; R: repetition of entire chop-nod pattern.

OD	OBSID	Target	SAA [°]	UTC Start time yyyy mon dd	hh:mm:ss	dur. [s]	fil	D	G	R
286	1342191129	1 Ceres	18.9	2010 Feb 24	03:44:28	198	B/R	Y	H	1
286	1342191132	1 Ceres	18.9	2010 Feb 24	03:59:32	179	G/R	Y	H	1
485	1342204323	1 Ceres	-5.1	2010 Sep 10	22:05:24	198	B/R	Y	H	1
485	1342204326	1 Ceres	-5.1	2010 Sep 10	22:20:48	179	G/R	Y	H	1
726	1342220292	1 Ceres	20.3	2011 May 10	02:35:44	460	B/R	Y	H	1
726	1342220295	1 Ceres	27.7	2011 May 10	02:53:42	198	G/R	Y	H	1
743	1342221737	1 Ceres	16.2	2011 May 27	05:57:00	325	B/R	Y	H	1
743	1342221740	1 Ceres	16.3	2011 May 27	06:13:27	179	G/R	Y	H	1
759	1342222565	1 Ceres	1.5	2011 Jun 12	07:09:10	401	B/R	Y	H	1
759	1342222568	1 Ceres	5.0	2011 Jun 12	07:26:37	179	G/R	Y	H	1
769	1342222937	1 Ceres	-1.6	2011 Jun 22	14:00:44	479	B/R	Y	L	1
769	1342222940	1 Ceres	-2.6	2011 Jun 22	14:18:53	198	G/R	Y	H	1
782	1342223698	1 Ceres	2.7	2011 Jul 05	02:29:42	1404	B/R	Y	L	1
782	1342223703	1 Ceres	-12.5	2011 Jul 05	03:32:23	198	G/R	Y	H	1
947	1342234466	1 Ceres	-3.5	2011 Dec 17	00:16:10	1615	B/R	Y	H	1
947	1342234469	1 Ceres	3.8	2011 Dec 17	00:43:21	179	G/R	Y	H	1
1237	1342252057	1 Ceres	-8.3	2012 Oct 02	05:15:33	279	B/R	Y	L	1
1237	1342252060	1 Ceres	-8.3	2012 Oct 02	05:31:37	179	G/R	Y	H	1
1244	1342252869	1 Ceres	-13.8	2012 Oct 09	13:12:03	327	B/R	Y	L	1
1244	1342252872	1 Ceres	-14.4	2012 Oct 09	13:28:48	179	G/R	Y	H	1

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Table 3: *continued*

OD	OBSID	Target	SAA [°]	UTC Start time yyyy mon dd	hh:mm:ss	dur. [s]	fil	D	G	R
1420	1342269274	1 Ceres	16.2	2013 Apr 02	23:45:51	455	B/R	Y	H	1
1420	1342269277	1 Ceres	14.5	2013 Apr 03	00:03:23	179	G/R	Y	H	1
245	1342189262	2 Pallas	18.0	2010 Jan 14	07:36:48	198	B/R	Y	H	1
245	1342189263	2 Pallas	18.0	2010 Jan 14	07:40:34	179	G/R	Y	H	1
446	1342202075	2 Pallas	1.3	2010 Aug 02	18:10:15	179	B/R	Y	H	1
446	1342202078	2 Pallas	1.3	2010 Aug 02	18:25:38	179	G/R	Y	H	1
686	1342217780	2 Pallas	21.7	2011 Mar 31	12:57:52	435	B/R	Y	H	1
686	1342217783	2 Pallas	22.3	2011 Mar 31	13:15:38	179	G/R	Y	H	1
889	1342231263	2 Pallas	-3.8	2011 Oct 20	04:10:52	455	B/R	Y	H	1
889	1342231266	2 Pallas	-1.8	2011 Oct 20	04:28:49	179	G/R	Y	H	1
1139	1342247432	2 Pallas	4.8	2012 Jun 25	20:39:57	512	G/R	Y	H	1
1139	1342247435	2 Pallas	4.3	2012 Jun 25	20:58:25	179	B/R	Y	H	1
1295	1342256232	2 Pallas	-9.0	2012 Nov 29	05:59:47	467	G/R	Y	H	1
1295	1342256235	2 Pallas	-14.3	2012 Nov 29	06:17:50	179	B/R	Y	H	1
221	1342188358	3 Juno	-0.6	2009 Dec 21	05:49:59	198	B/R	Y	H	1
221	1342188359	3 Juno	-0.6	2009 Dec 21	05:53:45	179	G/R	Y	H	1
593	1342211811	3 Juno	-10.6	2010 Dec 28	02:56:33	1569	G/R	Y	H	1
593	1342211814	3 Juno	-7.6	2010 Dec 28	03:23:21	179	B/R	Y	H	1
745	1342221855	3 Juno	-8.0	2011 May 29	07:37:57	284	B/R	Y	H	1
745	1342221858	3 Juno	-8.0	2011 May 29	07:54:18	198	G/R	Y	H	1
1002	1342238893	3 Juno	7.0	2012 Feb 09	21:42:09	730	G/R	Y	H	1
1002	1342238896	3 Juno	12.1	2012 Feb 09	22:01:59	179	B/R	Y	H	1
1184	1342249295	3 Juno	-6.3	2012 Aug 10	02:24:38	761	G/R	Y	H	1
1184	1342249298	3 Juno	-4.6	2012 Aug 10	02:44:41	198	B/R	Y	H	1
1428	1342269819	3 Juno	17.4	2013 Apr 10	15:11:23	234	B/R	Y	H	1
1428	1342269822	3 Juno	17.4	2013 Apr 10	15:27:05	179	G/R	Y	H	1
348	1342195623	4 Vesta	-15.5	2010 Apr 27	03:05:24	198	B/R	Y	H	1
348	1342195626	4 Vesta	-15.5	2010 Apr 27	03:20:27	198	G/R	Y	H	1
677	1342216607	4 Vesta	22.5	2011 Mar 22	09:50:55	412	B/R	Y	H	1
686	1342217777	4 Vesta	17.5	2011 Mar 31	12:38:32	387	B/R	Y	H	1
703	1342218743	4 Vesta	8.9	2011 Apr 17	13:52:41	261	B/R	Y	H	1
703	1342218746	4 Vesta	8.9	2011 Apr 17	14:08:49	198	G/R	Y	H	1
726	1342220286	4 Vesta	-0.5	2011 May 10	01:57:37	692	B/R	Y	H	1
726	1342220289	4 Vesta	-5.5	2011 May 10	02:17:45	179	G/R	Y	H	1
720	1342220582	4 Vesta	3.2	2011 May 04	10:49:27	418	B/R	Y	H	1
720	1342220585	4 Vesta	-1.7	2011 May 04	11:07:02	198	G/R	Y	H	1
743	1342221723	4 Vesta	-5.1	2011 May 27	01:54:30	1096	B/R	Y	H	1
743	1342221726	4 Vesta	-17.7	2011 May 27	02:17:21	198	G/R	Y	H	1
900	1342231688	4 Vesta	-4.4	2011 Oct 31	03:05:08	240	B/R	Y	H	1
900	1342231691	4 Vesta	-4.4	2011 Oct 31	03:20:53	179	G/R	Y	H	1
1181	1342249192	4 Vesta	25.4	2012 Aug 07	02:48:25	308	G/R	Y	H	1
1181	1342249193	4 Vesta	25.6	2012 Aug 07	02:53:21	198	B/R	Y	H	1
1202	1342250297	4 Vesta	11.9	2012 Aug 28	03:51:53	266	B/R	Y	H	1
1377	1342263920	4 Vesta	-10.4	2013 Feb 19	08:39:39	251	G/R	Y	H	1
1377	1342263923	4 Vesta	-10.4	2013 Feb 19	08:55:29	179	B/R	Y	H	1
413	1342199514	6 Hebe	-11.7	2010 Jul 01	03:07:58	198	B/R	Y	H	1
413	1342199517	6 Hebe	-11.7	2010 Jul 01	03:23:22	179	G/R	Y	H	1
579	1342211152	6 Hebe	-8.2	2010 Dec 14	00:05:37	255	B/R	Y	H	1
579	1342211155	6 Hebe	-8.2	2010 Dec 14	00:21:42	179	G/R	Y	H	1
627	1342213532	6 Hebe	18.1	2011 Jan 31	01:35:13	247	G/R	Y	H	1
627	1342213535	6 Hebe	18.1	2011 Jan 31	01:51:14	179	B/R	Y	H	1
957	1342235622	6 Hebe	-13.1	2011 Dec 26	21:41:36	460	B/R	Y	H	1
957	1342235625	6 Hebe	-17.4	2011 Dec 26	21:59:11	179	G/R	Y	H	1
1103	1342245941	6 Hebe	-2.0	2012 May 21	08:03:39	342	G/R	Y	H	1
1103	1342245944	6 Hebe	-2.1	2012 May 21	08:20:33	179	B/R	Y	H	1
1351	1342261990	6 Hebe	14.3	2013 Jan 24	04:28:49	483	G/R	Y	H	1
1351	1342261993	6 Hebe	23.5	2013 Jan 24	04:47:00	198	B/R	Y	H	1
101	1342182740	8 Flora	24.4	2009 Aug 23	11:11:23	4979	B/R	Y	L	30
566	1342210638	8 Flora	-10.1	2010 Dec 01	05:43:56	403	G/R	Y	H	1
566	1342210641	8 Flora	-9.8	2010 Dec 01	06:01:24	179	B/R	Y	H	1
969	1342236950	8 Flora	-9.8	2012 Jan 07	21:10:27	316	G/R	Y	H	1
969	1342236953	8 Flora	-9.9	2012 Jan 07	21:26:50	179	B/R	Y	H	1
1124	1342246945	8 Flora	-4.7	2012 Jun 11	00:24:44	381	G/R	Y	H	1
1124	1342246948	8 Flora	-4.9	2012 Jun 11	00:41:39	179	B/R	Y	H	1
1401	1342267585	8 Flora	21.6	2013 Mar 14	13:57:29	264	G/R	Y	H	1
1401	1342267588	8 Flora	21.6	2013 Mar 14	14:13:26	179	B/R	Y	H	1
343	1342195353	10 Hygiea	-10.1	2010 Apr 22	03:01:03	198	B/R	Y	H	1
343	1342195354	10 Hygiea	-10.1	2010 Apr 22	03:04:49	179	G/R	Y	H	1
649	1342214611	10 Hygiea	3.2	2011 Feb 21	23:47:51	1043	B/R	Y	H	1
649	1342214614	10 Hygiea	-7.8	2011 Feb 22	00:10:15	198	G/R	Y	H	1
663	1342215627	10 Hygiea	-20.0	2011 Mar 08	02:59:46	179	B/R	Y	H	1
860	1342229071	10 Hygiea	13.2	2011 Sep 20	21:14:52	1495	B/R	Y	H	1
860	1342229074	10 Hygiea	25.5	2011 Sep 20	21:41:02	198	G/R	Y	H	1
1083	1342245210	10 Hygiea	18.1	2012 May 01	08:41:32	1512	G/R	Y	H	1
1083	1342245213	10 Hygiea	15.9	2012 May 01	09:07:52	179	B/R	Y	H	1
1275	1342254753	10 Hygiea	3.2	2012 Nov 09	04:58:08	728	G/R	Y	H	1
1275	1342254756	10 Hygiea	-7.4	2012 Nov 09	05:17:55	198	B/R	Y	H	1
41	1342179011	18 Melpomene	1.1	2009 Jun 24	04:03:11	3338	B/R	Y	L	20
124	1342183903	19 Fortuna	-5.1	2009 Sep 15	07:52:49	175	B/R	Y	H	1
124	1342183904	19 Fortuna	-5.1	2009 Sep 15	07:56:35	195	G/R	Y	H	1
221	1342188346	20 Massalia	-0.2	2009 Dec 21	04:47:35	179	B/R	Y	H	1

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Table 3: *continued*

OD	OBSID	Target	SAA [°]	UTC Start time yyyy mon dd	hh:mm:ss	dur. [s]	fil	D	G	R
221	1342188347	20 Massalia	-0.2	2009 Dec 21	04:51:19	198	G/R	Y	H	1
792	1342224165	20 Massalia	17.9	2011 Jul 14	15:13:36	217	B/R	Y	H	1
792	1342224168	20 Massalia	17.9	2011 Jul 14	15:29:19	198	G/R	Y	H	1
1035	1342241347	20 Massalia	18.9	2012 Mar 13	21:18:17	336	B/R	Y	H	1
1035	1342241350	20 Massalia	18.5	2012 Mar 13	21:35:07	198	G/R	Y	H	1
1237	1342252017	20 Massalia	0.4	2012 Oct 02	01:07:55	393	G/R	Y	H	1
1237	1342252020	20 Massalia	-1.1	2012 Oct 02	01:24:56	179	B/R	Y	H	1
221	1342188332	21 Lutetia	-8.5	2009 Dec 21	01:43:43	198	G/R	Y	H	1
221	1342188333	21 Lutetia	-8.5	2009 Dec 21	01:47:29	179	B/R	Y	H	1
684	1342217410	21 Lutetia	-0.8	2011 Mar 29	20:42:08	335	B/R	Y	H	1
684	1342217413	21 Lutetia	-0.7	2011 Mar 29	20:58:57	198	G/R	Y	H	1
859	1342228946	21 Lutetia	-15.0	2011 Sep 19	20:45:40	1673	B/R	Y	H	1
859	1342228949	21 Lutetia	-13.1	2011 Sep 19	21:13:19	198	G/R	Y	H	1
1198	1342250103	21 Lutetia	18.1	2012 Aug 23	22:22:46	488	G/R	Y	H	1
1198	1342250106	21 Lutetia	23.9	2012 Aug 23	22:41:01	179	B/R	Y	H	1
1399	1342267260	21 Lutetia	-3.7	2013 Mar 13	01:55:12	357	G/R	Y	H	1
1399	1342267263	21 Lutetia	-4.2	2013 Mar 13	02:11:55	179	B/R	Y	H	1
497	1342205032	29 Amphitrite	-6.9	2010 Sep 22	21:22:28	198	B/R	Y	H	1
497	1342205035	29 Amphitrite	-6.9	2010 Sep 22	21:37:52	179	G/R	Y	H	1
245	1342189256	47 Aglaja	-19.5	2010 Jan 14	06:45:32	179	B/R	Y	H	1
245	1342189257	47 Aglaja	-19.5	2010 Jan 14	06:49:16	198	G/R	Y	H	1
286	1342191110	52 Europa	-16.0	2010 Feb 23	23:18:19	198	G/R	Y	H	1
286	1342191113	52 Europa	-16.0	2010 Feb 23	23:33:23	179	B/R	Y	H	1
613	1342212774	52 Europa	-13.6	2011 Jan 16	19:33:17	337	G/R	Y	H	1
613	1342212777	52 Europa	-13.7	2011 Jan 16	19:49:50	179	B/R	Y	H	1
1007	1342239463	52 Europa	25.1	2012 Feb 14	22:26:01	1209	G/R	Y	H	1
1007	1342239466	52 Europa	24.5	2012 Feb 14	22:49:49	179	B/R	Y	H	1
1216	1342250874	52 Europa	0.6	2012 Sep 11	05:27:48	339	G/R	Y	H	1
1216	1342250877	52 Europa	0.7	2012 Sep 11	05:44:39	198	B/R	Y	H	1
1442	1342270731	52 Europa	20.5	2013 Apr 24	14:54:27	369	G/R	Y	H	1
1442	1342270734	52 Europa	20.6	2013 Apr 24	15:11:35	198	B/R	Y	H	1
221	1342188352	65 Cybele	14.2	2009 Dec 21	05:18:37	179	B/R	Y	H	1
221	1342188353	65 Cybele	14.2	2009 Dec 21	05:22:22	179	G/R	Y	H	1
662	1342215367	65 Cybele	17.1	2011 Mar 06	20:46:09	528	B/R	Y	H	1
662	1342215370	65 Cybele	28.2	2011 Mar 06	21:04:45	198	G/R	Y	H	1
947	1342234460	88 Thisbe	-1.3	2011 Dec 16	23:29:59	632	B/R	Y	H	1
947	1342234463	88 Thisbe	-13.6	2011 Dec 16	23:48:58	198	G/R	Y	H	1
1110	1342246229	88 Thisbe	7.2	2012 May 28	06:24:58	253	G/R	Y	H	1
1110	1342246232	88 Thisbe	7.2	2012 May 28	06:40:49	179	B/R	Y	H	1
1346	1342261457	88 Thisbe	23.8	2013 Jan 19	00:17:14	309	G/R	Y	H	1
1346	1342261460	88 Thisbe	24.0	2013 Jan 19	00:33:48	198	B/R	Y	H	1
108	1342182969	360 Carlova	-14.8	2009 Aug 30	00:01:52	324	B/R	N	H	2
108	1342182970	360 Carlova	-14.8	2009 Aug 30	00:08:23	324	G/R	N	H	2
108	1342182971	360 Carlova	-14.8	2009 Aug 30	00:14:54	324	G/R	Y	H	2
108	1342182972	360 Carlova	-14.8	2009 Aug 30	00:21:25	324	B/R	Y	H	2
285	1342191019	423 Diotima	5.7	2010 Feb 23	09:59:36	179	B/R	Y	H	1
285	1342191022	423 Diotima	5.7	2010 Feb 23	10:14:38	198	G/R	Y	H	1
887	1342231105	704 Interamnia	1.4	2011 Oct 18	09:55:09	362	B/R	Y	H	1
887	1342231108	704 Interamnia	2.2	2011 Oct 18	10:12:13	198	G/R	Y	H	1
1146	1342247640	704 Interamnia	14.3	2012 Jul 02	23:08:23	1214	G/R	Y	H	1
1146	1342247643	704 Interamnia	27.5	2012 Jul 02	23:32:13	198	B/R	Y	H	1
1351	1342261949	704 Interamnia	-13.9	2013 Jan 23	23:34:55	280	G/R	Y	H	1
1351	1342261952	704 Interamnia	-13.9	2013 Jan 23	23:51:14	179	B/R	Y	H	1

Scan-map observations

Table 4: Herschel-PACS photometer **scan-map observations of MBAs** (proposals Calibration_coppacs_##, Calibration_pvpacs_##, Calibration_rppacs_###, DDT_dbockele_3, GT1_lorourke_9, and DDT_fhormuth_1), all taken in scan-map observing mode, and solar system object (SSO) tracking mode (except otherwise noted). SAA: solar aspect angle; dur.: duration of observation in seconds; fil: filter/band combination (B/R: 70/160 μm; G/R: 100/160 μm); G: low (L) or high (H) gain; R: repetition of entire scan map; S: scan-speed in ″/s, scan-map parameters: Len: scan-leg length (in arc min) × n: number of scan legs × sep: scan-leg separation (in arc sec); ang.: satellite scan angle in degrees with respect to instrument reference frame (i) or the sky reference frame (s).

OD	OBSID	Target	SAA [°]	UTC Start time yyyy mon dd	hh:mm:ss	Dur [s]	Fil	G	R	S ″/s	Len×n×sep ′×#×″	ang. [°]
286	1342191130	1 Ceres	18.9	2010 Feb 24	03:49:10	311	B/R	H	1	20	2.5×10× 4	70(i)
286	1342191131	1 Ceres	18.9	2010 Feb 24	03:54:49	311	B/R	H	1	20	2.5×10× 4	110(i)
286	1342191133	1 Ceres	18.9	2010 Feb 24	04:04:13	311	G/R	H	1	20	2.5×10× 4	70(i)
286	1342191134	1 Ceres	18.9	2010 Feb 24	04:09:52	311	G/R	H	1	20	2.5×10× 4	110(i)
485	1342204324	1 Ceres	-5.1	2010 Sep 10	22:10:10	320	B/R	H	1	20	3.0×10× 4	70(i)

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Table 4: *continued*

OD	OBSID	Target	SAA [°]	UTC Start time yyyy mon dd	hh:mm:ss	Dur [s]	Fil	G	R	S ″/s	Len×n×sep ′×#×″	ang. [°]
485	1342204325	1 Ceres	-5.1	2010 Sep 10	22:15:59	320	B/R	H	1	20	3.0×10× 4	110(i)
485	1342204327	1 Ceres	-5.1	2010 Sep 10	22:25:33	320	G/R	H	1	20	3.0×10× 4	70(i)
485	1342204328	1 Ceres	-5.1	2010 Sep 10	22:31:22	320	G/R	H	1	20	3.0×10× 4	110(i)
726	1342220293	1 Ceres	27.7	2011 May 10	02:43:05	320	B/R	H	1	20	3.0×10× 4	70(i)
726	1342220294	1 Ceres	27.7	2011 May 10	02:48:54	320	B/R	H	1	20	3.0×10× 4	70(i)
726	1342220296	1 Ceres	27.7	2011 May 10	02:58:28	320	G/R	H	1	20	3.0×10× 4	70(i)
726	1342220297	1 Ceres	27.7	2011 May 10	03:04:17	320	G/R	H	1	20	3.0×10× 4	110(i)
734	1342221350	1 Ceres	22.3	2011 May 18	11:25:25	1213	B/R	H	1	20	10.0×21×20	45(i)
734	1342221351	1 Ceres	22.3	2011 May 18	11:45:04	1090	B/R	H	1	20	10.0×21×20	135(i)
734	1342221352	1 Ceres	22.1	2011 May 18	12:03:42	1090	G/R	H	1	20	10.0×21×20	45(i)
734	1342221353	1 Ceres	22.2	2011 May 18	12:22:20	1090	G/R	H	1	20	10.0×21×20	135(i)
743	1342221738	1 Ceres	16.3	2011 May 27	06:02:49	320	B/R	H	1	20	3.0×10× 4	70(i)
743	1342221739	1 Ceres	16.3	2011 May 27	06:08:38	320	B/R	H	1	20	3.0×10× 4	110(i)
743	1342221741	1 Ceres	16.3	2011 May 27	06:18:12	320	G/R	H	1	20	3.0×10× 4	70(i)
743	1342221742	1 Ceres	16.3	2011 May 27	06:23:55	308	G/R	H	1	20	3.0×10× 4	110(i)
759	1342222566	1 Ceres	5.0	2011 Jun 12	07:15:59	320	B/R	H	1	20	3.0×10× 4	70(i)
759	1342222567	1 Ceres	5.1	2011 Jun 12	07:21:48	320	B/R	H	1	20	3.0×10× 4	110(i)
759	1342222569	1 Ceres	5.0	2011 Jun 12	07:31:22	320	G/R	H	1	20	3.0×10× 4	70(i)
759	1342222570	1 Ceres	5.1	2011 Jun 12	07:37:11	320	G/R	H	1	20	3.0×10× 4	110(i)
769	1342222938	1 Ceres	-2.6	2011 Jun 22	14:08:17	321	B/R	L	1	20	3.0×10× 4	70(i)
769	1342222939	1 Ceres	-2.6	2011 Jun 22	14:14:06	321	B/R	L	1	20	3.0×10× 4	110(i)
769	1342222941	1 Ceres	-2.6	2011 Jun 22	14:23:39	320	G/R	H	1	20	3.0×10× 4	70(i)
769	1342222942	1 Ceres	-2.6	2011 Jun 22	14:29:28	320	G/R	H	1	20	3.0×10× 4	110(i)
782	1342223699	1 Ceres	-12.4	2011 Jul 05	02:44:31	321	B/R	L	1	20	3.0×10× 4	70(i)
782	1342223700	1 Ceres	-12.4	2011 Jul 05	02:50:20	321	B/R	L	1	20	3.0×10× 4	110(i)
782	1342223701	1 Ceres	-12.5	2011 Jul 05	03:02:33	1090	B/R	L	1	20	10.0×21×20	45(i)
782	1342223702	1 Ceres	-12.4	2011 Jul 05	03:21:11	1090	B/R	L	1	20	10.0×21×20	135(i)
782	1342223704	1 Ceres	-12.5	2011 Jul 05	03:37:09	320	G/R	H	1	20	3.0×10× 4	70(i)
782	1342223705	1 Ceres	-12.4	2011 Jul 05	03:42:58	320	G/R	H	1	20	3.0×10× 4	110(i)
782	1342223706	1 Ceres	-12.5	2011 Jul 05	03:55:12	1090	G/R	H	1	20	10.0×21×20	45(i)
782	1342223707	1 Ceres	-12.4	2011 Jul 05	04:13:50	1090	G/R	H	1	20	10.0×21×20	135(i)
947	1342234467	1 Ceres	3.8	2011 Dec 17	00:32:43	320	B/R	H	1	20	3.0×10× 4	70(i)
947	1342234468	1 Ceres	3.9	2011 Dec 17	00:38:32	320	B/R	H	1	20	3.0×10× 4	110(i)
947	1342234470	1 Ceres	3.8	2011 Dec 17	00:48:06	320	G/R	H	1	20	3.0×10× 4	70(i)
947	1342234471	1 Ceres	3.9	2011 Dec 17	00:53:55	320	G/R	H	1	20	3.0×10× 4	110(i)
1237	1342252058	1 Ceres	-8.3	2012 Oct 02	05:20:59	320	B/R	H	1	20	3.0×10× 4	70(i)
1237	1342252059	1 Ceres	-8.2	2012 Oct 02	05:26:48	320	B/R	H	1	20	3.0×10× 4	110(i)
1237	1342252061	1 Ceres	-8.3	2012 Oct 02	05:36:22	320	G/R	H	1	20	3.0×10× 4	70(i)
1237	1342252062	1 Ceres	-8.2	2012 Oct 02	05:42:11	320	G/R	H	1	20	3.0×10× 4	110(i)
1244	1342252870	1 Ceres	-14.4	2012 Oct 09	13:18:10	320	B/R	H	1	20	3.0×10× 4	70(i)
1244	1342252871	1 Ceres	-14.3	2012 Oct 09	13:23:59	320	B/R	H	1	20	3.0×10× 4	110(i)
1244	1342252873	1 Ceres	-14.4	2012 Oct 09	13:33:33	320	G/R	H	1	20	3.0×10× 4	70(i)
1244	1342252874	1 Ceres	-14.3	2012 Oct 09	13:39:22	320	G/R	H	1	20	3.0×10× 4	110(i)
1244	1342252875	1 Ceres	-14.4	2012 Oct 09	13:51:36	1090	B/R	L	1	20	10.0×21×20	45(i)
1244	1342252876	1 Ceres	-14.3	2012 Oct 09	14:10:14	1090	B/R	L	1	20	10.0×21×20	135(i)
1244	1342252877	1 Ceres	-14.5	2012 Oct 09	14:28:52	1090	G/R	H	1	20	10.0×21×20	45(i)
1244	1342252878	1 Ceres	-14.3	2012 Oct 09	14:47:30	1090	G/R	H	1	20	10.0×21×20	135(i)
1420	1342269275	1 Ceres	14.5	2013 Apr 02	23:52:46	321	B/R	H	1	20	3.0×10× 4	70(i)
1420	1342269276	1 Ceres	14.6	2013 Apr 02	23:58:35	321	B/R	H	1	20	3.0×10× 4	110(i)
1420	1342269278	1 Ceres	14.5	2013 Apr 03	00:08:09	321	G/R	H	1	20	3.0×10× 4	70(i)
1420	1342269279	1 Ceres	14.6	2013 Apr 03	00:13:58	321	G/R	H	1	20	3.0×10× 4	110(i)
1441	1342270787	1 Ceres[1]	23.9	2013 Apr 23	17:33:23	1243	B/R	H	1	20	3.0×10× 4	70(i)
1441	1342270798	1 Ceres[1]	27.8	2013 Apr 23	18:33:24	676	B/R	H	1	20	3.0×10× 4	70(i)
1441	1342270803	1 Ceres[1]	27.9	2013 Apr 23	19:40:49	578	B/R	H	1	20	3.0×10× 4	70(i)
1441	1342270808	1 Ceres[1]	27.9	2013 Apr 23	20:34:25	647	B/R	H	1	20	3.0×10× 4	70(i)
1441	1342270813	1 Ceres[1]	28.0	2013 Apr 23	21:39:58	513	B/R	H	1	20	3.0×10× 4	70(i)
1441	1342270818	1 Ceres[1]	27.8	2013 Apr 23	22:46:13	586	B/R	H	1	20	3.0×10× 4	70(i)
1441	1342270823	1 Ceres[1]	28.0	2013 Apr 23	23:52:27	560	B/R	H	1	20	3.0×10× 4	70(i)
1441	1342270828	1 Ceres[1]	28.1	2013 Apr 24	00:58:33	564	B/R	H	1	20	3.0×10× 4	70(i)
1441	1342270841	1 Ceres[1]	28.0	2013 Apr 24	01:49:20	602	B/R	H	1	20	3.0×10× 4	70(i)
1441	1342270846	1 Ceres[1]	28.1	2013 Apr 24	02:55:02	534	B/R	H	1	20	3.0×10× 4	70(i)
1441	1342270851	1 Ceres[1]	27.5	2013 Apr 24	04:02:04	610	B/R	H	1	20	3.0×10× 4	70(i)
1441	1342270856	1 Ceres[1]	27.9	2013 Apr 24	05:09:17	592	B/R	H	1	20	3.0×10× 4	70(i)
245	1342189264	2 Pallas	18.1	2010 Jan 14	07:45:04	289	B/R	H	1	20	4.0× 8× 4	63(i)
245	1342189265	2 Pallas	18.0	2010 Jan 14	07:50:21	289	B/R	H	1	20	4.0× 8× 4	117(i)
245	1342189266	2 Pallas	18.1	2010 Jan 14	07:55:38	289	G/R	H	1	20	4.0× 8× 4	63(i)
245	1342189267	2 Pallas	18.0	2010 Jan 14	08:00:55	289	G/R	H	1	20	4.0× 8× 4	117(i)
446	1342202076	2 Pallas	1.3	2010 Aug 02	18:15:00	320	B/R	H	1	20	3.0×10× 4	70(i)
446	1342202077	2 Pallas	1.3	2010 Aug 02	18:20:49	320	B/R	H	1	20	3.0×10× 4	110(i)
446	1342202079	2 Pallas	1.3	2010 Aug 02	18:30:23	320	G/R	H	1	20	3.0×10× 4	70(i)
446	1342202080	2 Pallas	1.3	2010 Aug 02	18:36:12	320	G/R	H	1	20	3.0×10× 4	110(i)
686	1342217781	2 Pallas	22.3	2011 Mar 31	13:05:00	320	B/R	H	1	20	3.0×10× 4	70(i)
686	1342217782	2 Pallas	22.4	2011 Mar 31	13:10:49	320	B/R	H	1	20	3.0×10× 4	110(i)
686	1342217784	2 Pallas	22.3	2011 Mar 31	13:20:24	321	G/R	H	1	20	3.0×10× 4	70(i)
686	1342217785	2 Pallas	22.3	2011 Mar 31	13:26:12	320	G/R	H	1	20	3.0×10× 4	110(i)
720	1342220588	2 Pallas	0.1	2011 May 04	11:25:56	619	B/R	H	1	20	3.0×10× 4	70(i)
720	1342220589	2 Pallas	0.2	2011 May 04	11:34:13	320	B/R	H	1	20	3.0×10× 4	110(i)
720	1342220590	2 Pallas	0.1	2011 May 04	11:40:02	320	G/R	H	1	20	3.0×10× 4	70(i)
720	1342220591	2 Pallas	0.2	2011 May 04	11:45:51	320	G/R	H	1	20	3.0×10× 4	110(i)
889	1342231264	2 Pallas	-1.8	2011 Oct 20	04:18:11	320	B/R	H	1	20	3.0×10× 4	70(i)
889	1342231265	2 Pallas	-1.8	2011 Oct 20	04:24:00	320	B/R	H	1	20	3.0×10× 4	110(i)
889	1342231267	2 Pallas	-1.8	2011 Oct 20	04:33:34	320	G/R	H	1	20	3.0×10× 4	70(i)
889	1342231268	2 Pallas	-1.8	2011 Oct 20	04:39:23	320	G/R	H	1	20	3.0×10× 4	110(i)

continued on next page

Table 4: *continued*

OD	OBSID	Target	SAA [°]	UTC Start time yyyy mon dd	hh:mm:ss	Dur [s]	Fil	G	R	S ″/s	Len×n×sep ′×#×″	ang. [°]
1139	1342247433	2 Pallas	4.3	2012 Jun 25	20:47:47	320	G/R	H	1	20	3.0×10× 4	70(i)
1139	1342247434	2 Pallas	4.4	2012 Jun 25	20:53:36	320	G/R	H	1	20	3.0×10× 4	110(i)
1139	1342247436	2 Pallas	4.3	2012 Jun 25	21:03:11	321	B/R	H	1	20	3.0×10× 4	70(i)
1139	1342247437	2 Pallas	4.4	2012 Jun 25	21:08:59	320	B/R	H	1	20	3.0×10× 4	110(i)
1295	1342256233	2 Pallas	-14.3	2012 Nov 29	06:07:12	320	G/R	H	1	20	3.0×10× 4	70(i)
1295	1342256234	2 Pallas	-14.3	2012 Nov 29	06:13:01	320	G/R	H	1	20	3.0×10× 4	110(i)
1295	1342256236	2 Pallas	-14.3	2012 Nov 29	06:22:35	320	B/R	H	1	20	3.0×10× 4	70(i)
1295	1342256237	2 Pallas	-14.3	2012 Nov 29	06:28:24	320	B/R	H	1	20	3.0×10× 4	110(i)
221	1342188360	3 Juno	-0.5	2009 Dec 21	05:58:15	289	B/R	H	1	20	4.0× 8× 4	63(i)
221	1342188361	3 Juno	-0.6	2009 Dec 21	06:03:32	289	B/R	H	1	20	4.0× 8× 4	117(i)
221	1342188362	3 Juno	-0.5	2009 Dec 21	06:08:49	289	G/R	H	1	20	4.0× 8× 4	63(i)
221	1342188363	3 Juno	-0.6	2009 Dec 21	06:14:06	289	G/R	H	1	20	4.0× 8× 4	117(i)
593	1342211812	3 Juno	-7.6	2010 Dec 28	03:12:44	321	G/R	H	1	20	3.0×10× 4	70(i)
593	1342211813	3 Juno	-7.6	2010 Dec 28	03:18:33	321	G/R	H	1	20	3.0×10× 4	110(i)
593	1342211815	3 Juno	-7.6	2010 Dec 28	03:28:06	320	B/R	H	1	20	3.0×10× 4	70(i)
593	1342211816	3 Juno	-7.6	2010 Dec 28	03:33:55	320	B/R	H	1	20	3.0×10× 4	110(i)
745	1342221856	3 Juno	-8.0	2011 May 29	07:43:42	289	B/R	H	1	20	3.0×10× 4	70(i)
745	1342221857	3 Juno	-8.0	2011 May 29	07:49:30	320	B/R	H	1	20	3.0×10× 4	110(i)
745	1342221859	3 Juno	-8.0	2011 May 29	07:59:04	320	G/R	H	1	20	3.0×10× 4	70(i)
745	1342221860	3 Juno	-8.0	2011 May 29	08:04:54	289	G/R	H	1	20	3.0×10× 4	110(i)
1002	1342238894	3 Juno	12.1	2012 Feb 09	21:51:22	321	G/R	H	1	20	3.0×10× 4	70(i)
1002	1342238895	3 Juno	12.1	2012 Feb 09	21:57:11	321	G/R	H	1	20	3.0×10× 4	110(i)
1002	1342238897	3 Juno	12.0	2012 Feb 09	22:06:45	321	B/R	H	1	20	3.0×10× 4	70(i)
1002	1342238898	3 Juno	12.1	2012 Feb 09	22:12:33	320	B/R	H	1	20	3.0×10× 4	110(i)
1184	1342249296	3 Juno	-4.6	2012 Aug 10	02:34:05	321	G/R	H	1	20	3.0×10× 4	70(i)
1184	1342249297	3 Juno	-4.6	2012 Aug 10	02:39:54	321	G/R	H	1	20	3.0×10× 4	110(i)
1184	1342249299	3 Juno	-4.6	2012 Aug 10	02:49:28	321	B/R	H	1	20	3.0×10× 4	70(i)
1184	1342249300	3 Juno	-4.6	2012 Aug 10	02:55:17	321	B/R	H	1	20	3.0×10× 4	110(i)
1428	1342269820	3 Juno	17.4	2013 Apr 10	15:16:28	321	B/R	H	1	20	3.0×10× 4	70(i)
1428	1342269821	3 Juno	17.5	2013 Apr 10	15:22:17	321	B/R	H	1	20	3.0×10× 4	110(i)
1428	1342269823	3 Juno	17.4	2013 Apr 10	15:31:51	321	G/R	H	1	20	3.0×10× 4	70(i)
1428	1342269824	3 Juno	17.4	2013 Apr 10	15:37:40	321	G/R	H	1	20	3.0×10× 4	110(i)
160	1342186132	4 Vesta	23.2	2009 Oct 21	01:14:00	1264	G/R	H	1	10	10.0×15× 3	63(i)
160	1342186133	4 Vesta	23.2	2009 Oct 21	01:32:29	902	G/R	H	1	20	10.0×15× 3	63(i)
160	1342186134	4 Vesta	23.2	2009 Oct 21	01:47:40	868	G/R	H	1	60	10.0×15× 3	63(i)
160	1342186135	4 Vesta	23.2	2009 Oct 21	02:05:52	1264	B/R	H	1	10	10.0×15× 3	63(i)
160	1342186136	4 Vesta	23.2	2009 Oct 21	02:24:21	902	B/R	H	1	20	10.0×15× 3	63(i)
160	1342186137	4 Vesta	23.2	2009 Oct 21	02:39:32	868	B/R	H	1	60	10.0×15× 3	63(i)
345	1342195470	4 Vesta	-17.9	2010 Apr 24	00:17:01	728	B/R	H	1	60	10.0×15× 3	42(i)
345	1342195471	4 Vesta	-17.9	2010 Apr 24	00:29:47	728	B/R	H	1	60	10.0×15× 3	318(i)
345	1342195472	4 Vesta	-18.0	2010 Apr 24	00:42:57	776	B/R	H	1	20	10.0×15× 3	42(i)
345	1342195473	4 Vesta	-18.0	2010 Apr 24	00:56:21	776	B/R	H	1	20	10.0×15× 3	318(i)
345	1342195474	4 Vesta	-17.9	2010 Apr 24	01:09:21	728	G/R	H	1	60	10.0×15× 3	42(i)
345	1342195475	4 Vesta	-17.9	2010 Apr 24	01:22:07	728	G/R	H	1	60	10.0×15× 3	318(i)
345	1342195476	4 Vesta	-18.0	2010 Apr 24	01:35:17	776	G/R	H	1	20	10.0×15× 3	42(i)
345	1342195477	4 Vesta	-17.9	2010 Apr 24	01:48:41	776	G/R	H	1	20	10.0×15× 3	318(i)
348	1342195622	4 Vesta	-15.5	2010 Apr 27	02:30:16	3960	G/R	H	1	20	10.0×80× 3	20(i)
348	1342195624	4 Vesta	-15.5	2010 Apr 27	03:10:06	311	B/R	H	1	20	2.5×10× 4	70(i)
348	1342195625	4 Vesta	-15.5	2010 Apr 27	03:15:45	311	B/R	H	1	20	2.5×10× 4	110(i)
348	1342195627	4 Vesta	-15.5	2010 Apr 27	03:25:09	311	G/R	H	1	20	2.5×10× 4	70(i)
348	1342195628	4 Vesta	-15.5	2010 Apr 27	03:30:48	311	G/R	H	1	20	2.5×10× 4	110(i)
677	1342216608	4 Vesta	24.0	2011 Mar 22	09:57:28	320	B/R	H	1	20	3.0×10× 4	70(i)
677	1342216609	4 Vesta	24.0	2011 Mar 22	10:03:18	289	B/R	H	1	20	3.0×10× 4	110(i)
677	1342216610	4 Vesta	23.9	2011 Mar 22	10:15:31	1090	B/R	H	1	20	10.0×21×20	45(i)
677	1342216611	4 Vesta	24.0	2011 Mar 22	10:34:09	1090	B/R	H	1	20	10.0×21×20	135(i)
677	1342216612	4 Vesta	23.9	2011 Mar 22	10:52:47	1090	G/R	H	1	20	10.0×21×20	45(i)
677	1342216613	4 Vesta	24.0	2011 Mar 22	11:11:25	1090	G/R	H	1	20	10.0×21×20	135(i)
686	1342217778	4 Vesta	18.8	2011 Mar 31	12:44:52	320	B/R	H	1	20	3.0×10× 4	70(i)
686	1342217779	4 Vesta	18.9	2011 Mar 31	12:50:41	320	B/R	H	1	20	3.0×10× 4	110(i)
703	1342218744	4 Vesta	8.9	2011 Apr 17	13:58:12	320	B/R	H	1	20	3.0×10× 4	70(i)
703	1342218745	4 Vesta	8.9	2011 Apr 17	14:04:01	320	B/R	H	1	20	3.0×10× 4	110(i)
703	1342218747	4 Vesta	8.9	2011 Apr 17	14:13:35	320	G/R	H	1	20	3.0×10× 4	70(i)
703	1342218748	4 Vesta	8.9	2011 Apr 17	14:19:25	321	G/R	H	1	20	3.0×10× 4	110(i)
726	1342220287	4 Vesta	-5.5	2011 May 10	02:07:07	320	B/R	H	1	20	3.0×10× 4	70(i)
726	1342220288	4 Vesta	-5.5	2011 May 10	02:12:56	320	B/R	H	1	20	3.0×10× 4	110(i)
726	1342220290	4 Vesta	-5.5	2011 May 10	02:22:30	320	G/R	H	1	20	3.0×10× 4	70(i)
726	1342220291	4 Vesta	-5.5	2011 May 10	02:28:19	320	G/R	H	1	20	3.0×10× 4	110(i)
720	1342220583	4 Vesta	-1.7	2011 May 04	10:56:25	320	B/R	H	1	20	3.0×10× 4	70(i)
720	1342220584	4 Vesta	-1.7	2011 May 04	11:02:14	320	B/R	H	1	20	3.0×10× 4	110(i)
720	1342220586	4 Vesta	-1.7	2011 May 04	11:11:48	320	G/R	H	1	20	3.0×10× 4	70(i)
720	1342220587	4 Vesta	-1.7	2011 May 04	11:17:37	320	G/R	H	1	20	3.0×10× 4	110(i)
743	1342221724	4 Vesta	-17.7	2011 May 27	02:06:44	320	B/R	H	1	20	3.0×10× 4	70(i)
743	1342221725	4 Vesta	-17.7	2011 May 27	02:12:33	320	B/R	H	1	20	3.0×10× 4	110(i)
743	1342221727	4 Vesta	-17.7	2011 May 27	02:22:07	320	G/R	H	1	20	3.0×10× 4	70(i)
743	1342221728	4 Vesta	-17.7	2011 May 27	02:27:56	320	G/R	H	1	20	3.0×10× 4	110(i)
900	1342231689	4 Vesta	-4.4	2011 Oct 31	03:10:15	320	B/R	H	1	20	3.0×10× 4	70(i)
900	1342231690	4 Vesta	-4.4	2011 Oct 31	03:16:04	320	B/R	H	1	20	3.0×10× 4	110(i)
900	1342231692	4 Vesta	-4.4	2011 Oct 31	03:25:38	320	G/R	H	1	20	3.0×10× 4	70(i)
900	1342231693	4 Vesta	-4.4	2011 Oct 31	03:31:27	320	G/R	H	1	20	3.0×10× 4	110(i)
1179	1342249092	αTau-Vesta[4]	26.6	2012 Aug 05	13:20:51	1620	B/R	H	1	20	20.0×20× 5	170(s)
1179	1342249093	αTau-Vesta[4]	26.6	2012 Aug 05	13:48:10	1620	G/R	H	1	20	20.0×20× 5	172(s)
1202	1342250298	4 Vesta	11.8	2012 Aug 28	03:57:13	320	B/R	H	1	20	3.0×10× 4	70(i)
1202	1342250299	4 Vesta	11.9	2012 Aug 28	04:03:02	320	B/R	H	1	20	3.0×10× 4	110(i)

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Table 4: *continued*

OD	OBSID	Target	SAA [°]	UTC Start time yyyy mon dd	hh:mm:ss	Dur [s]	Fil	G	R	S ″/s	Len×n×sep ′×#×″	ang. [°]
1377	1342263921	4 Vesta	-10.4	2013 Feb 19	08:44:52	321	G/R	H	1	20	3.0×10× 4	70(i)
1377	1342263922	4 Vesta	-10.4	2013 Feb 19	08:50:41	321	G/R	H	1	20	3.0×10× 4	110(i)
1377	1342263924	4 Vesta	-10.4	2013 Feb 19	09:00:15	321	B/R	H	1	20	3.0×10× 4	70(i)
1377	1342263925	4 Vesta	-10.4	2013 Feb 19	09:06:04	321	B/R	H	1	20	3.0×10× 4	110(i)
413	1342199515	6 Hebe	-11.7	2010 Jul 01	03:12:44	320	B/R	H	1	20	3.0×10× 4	70(i)
413	1342199516	6 Hebe	-11.6	2010 Jul 01	03:18:33	320	B/R	H	1	20	3.0×10× 4	110(i)
413	1342199518	6 Hebe	-11.7	2010 Jul 01	03:28:07	320	G/R	H	1	20	3.0×10× 4	70(i)
413	1342199519	6 Hebe	-11.6	2010 Jul 01	03:33:56	320	G/R	H	1	20	3.0×10× 4	110(i)
579	1342211153	6 Hebe	-8.2	2010 Dec 14	00:11:04	320	B/R	H	1	20	3.0×10× 4	70(i)
579	1342211154	6 Hebe	-8.2	2010 Dec 14	00:16:53	320	B/R	H	1	20	3.0×10× 4	110(i)
579	1342211156	6 Hebe	-8.2	2010 Dec 14	00:26:27	320	G/R	H	1	20	3.0×10× 4	70(i)
579	1342211157	6 Hebe	-8.2	2010 Dec 14	00:32:16	320	G/R	H	1	20	3.0×10× 4	110(i)
627	1342213533	6 Hebe	18.1	2011 Jan 31	01:40:37	321	G/R	H	1	20	3.0×10× 4	70(i)
627	1342213534	6 Hebe	18.1	2011 Jan 31	01:46:25	320	G/R	H	1	20	3.0×10× 4	110(i)
627	1342213536	6 Hebe	18.1	2011 Jan 31	01:56:00	321	B/R	H	1	20	3.0×10× 4	70(i)
627	1342213537	6 Hebe	18.1	2011 Jan 31	02:01:49	321	B/R	H	1	20	3.0×10× 4	110(i)
957	1342235623	6 Hebe	-17.4	2011 Dec 26	21:48:34	321	B/R	H	1	20	3.0×10× 4	70(i)
957	1342235624	6 Hebe	-17.4	2011 Dec 26	21:54:22	320	B/R	H	1	20	3.0×10× 4	110(i)
957	1342235626	6 Hebe	-17.4	2011 Dec 26	22:03:57	321	G/R	H	1	20	3.0×10× 4	70(i)
957	1342235627	6 Hebe	-17.4	2011 Dec 26	22:09:46	321	G/R	H	1	20	3.0×10× 4	110(i)
1103	1342245942	6 Hebe	-2.1	2012 May 21	08:09:56	321	G/R	H	1	20	3.0×10× 4	70(i)
1103	1342245943	6 Hebe	-2.1	2012 May 21	08:15:45	321	G/R	H	1	20	3.0×10× 4	110(i)
1103	1342245945	6 Hebe	-2.1	2012 May 21	08:25:19	321	B/R	H	1	20	3.0×10× 4	70(i)
1103	1342245946	6 Hebe	-2.0	2012 May 21	08:31:08	321	B/R	H	1	20	3.0×10× 4	110(i)
1351	1342261991	6 Hebe	23.5	2013 Jan 24	04:36:24	321	G/R	H	1	20	3.0×10× 4	70(i)
1351	1342261992	6 Hebe	23.5	2013 Jan 24	04:42:13	321	G/R	H	1	20	3.0×10× 4	110(i)
1351	1342261994	6 Hebe	23.5	2013 Jan 24	04:51:47	321	B/R	H	1	20	3.0×10× 4	70(i)
1351	1342261995	6 Hebe	23.5	2013 Jan 24	04:57:35	320	B/R	H	1	20	3.0×10× 4	110(i)
566	1342210639	8 Flora	-9.9	2010 Dec 01	05:50:46	320	G/R	H	1	20	3.0×10× 4	70(i)
566	1342210640	8 Flora	-9.8	2010 Dec 01	05:56:35	320	G/R	H	1	20	3.0×10× 4	110(i)
566	1342210642	8 Flora	-9.9	2010 Dec 01	06:06:09	320	B/R	H	1	20	3.0×10× 4	70(i)
566	1342210643	8 Flora	-9.8	2010 Dec 01	06:11:58	320	B/R	H	1	20	3.0×10× 4	110(i)
969	1342236951	8 Flora	-9.9	2012 Jan 07	21:16:13	321	G/R	H	1	20	3.0×10× 4	70(i)
969	1342236952	8 Flora	-9.8	2012 Jan 07	21:22:02	321	G/R	H	1	20	3.0×10× 4	110(i)
969	1342236954	8 Flora	-9.9	2012 Jan 07	21:31:36	321	B/R	H	1	20	3.0×10× 4	70(i)
969	1342236955	8 Flora	-9.8	2012 Jan 07	21:37:25	321	B/R	H	1	20	3.0×10× 4	110(i)
1124	1342246946	8 Flora	-4.9	2012 Jun 11	00:31:02	321	G/R	H	1	20	3.0×10× 4	70(i)
1124	1342246947	8 Flora	-4.9	2012 Jun 11	00:36:51	321	G/R	H	1	20	3.0×10× 4	110(i)
1124	1342246949	8 Flora	-4.9	2012 Jun 11	00:46:25	321	B/R	H	1	20	3.0×10× 4	70(i)
1124	1342246950	8 Flora	-4.9	2012 Jun 11	00:52:14	321	B/R	H	1	20	3.0×10× 4	110(i)
1401	1342267586	8 Flora	21.6	2013 Mar 14	14:02:49	321	G/R	H	1	20	3.0×10× 4	70(i)
1401	1342267587	8 Flora	21.6	2013 Mar 14	14:08:38	321	G/R	H	1	20	3.0×10× 4	110(i)
1401	1342267589	8 Flora	21.6	2013 Mar 14	14:18:12	321	B/R	H	1	20	3.0×10× 4	70(i)
1401	1342267590	8 Flora	21.6	2013 Mar 14	14:24:01	321	B/R	H	1	20	3.0×10× 4	110(i)
649	1342214612	10 Hygiea	-7.8	2011 Feb 21	23:59:38	320	B/R	H	1	20	3.0×10× 4	70(i)
649	1342214613	10 Hygiea	-7.8	2011 Feb 22	00:05:27	320	B/R	H	1	20	3.0×10× 4	110(i)
649	1342214615	10 Hygiea	-7.8	2011 Feb 22	00:15:01	320	G/R	H	1	20	3.0×10× 4	70(i)
649	1342214616	10 Hygiea	-7.8	2011 Feb 22	00:20:50	320	G/R	H	1	20	3.0×10× 4	110(i)
663	1342215628	10 Hygiea	-20.0	2011 Mar 08	03:04:31	320	B/R	H	1	20	3.0×10× 4	70(i)
663	1342215629	10 Hygiea	-20.0	2011 Mar 08	03:10:20	320	B/R	H	1	20	3.0×10× 4	110(i)
663	1342215630	10 Hygiea	-20.1	2011 Mar 08	03:22:34	1090	B/R	H	1	20	10.0×21×20	45(i)
663	1342215631	10 Hygiea	-19.9	2011 Mar 08	03:41:12	1090	B/R	H	1	20	10.0×21×20	135(i)
860	1342229072	10 Hygiea	25.5	2011 Sep 20	21:30:25	320	B/R	H	1	20	3.0×10× 4	70(i)
860	1342229073	10 Hygiea	25.5	2011 Sep 20	21:36:14	320	B/R	H	1	20	3.0×10× 4	110(i)
860	1342229075	10 Hygiea	25.5	2011 Sep 20	21:45:48	320	G/R	H	1	20	3.0×10× 4	70(i)
860	1342229076	10 Hygiea	25.6	2011 Sep 20	21:51:37	320	G/R	H	1	20	3.0×10× 4	110(i)
1083	1342245211	10 Hygiea	15.9	2012 May 01	08:57:14	320	G/R	H	1	20	3.0×10× 4	70(i)
1083	1342245212	10 Hygiea	16.0	2012 May 01	09:03:04	321	G/R	H	1	20	3.0×10× 4	110(i)
1083	1342245214	10 Hygiea	15.9	2012 May 01	09:12:37	320	B/R	H	1	20	3.0×10× 4	70(i)
1083	1342245215	10 Hygiea	16.0	2012 May 01	09:18:27	321	B/R	H	1	20	3.0×10× 4	110(i)
1275	1342254754	10 Hygiea	-7.4	2012 Nov 09	05:07:19	321	G/R	H	1	20	3.0×10× 4	70(i)
1275	1342254755	10 Hygiea	-7.4	2012 Nov 09	05:13:07	320	G/R	H	1	20	3.0×10× 4	110(i)
1275	1342254757	10 Hygiea	-7.4	2012 Nov 09	05:22:41	320	B/R	H	1	20	3.0×10× 4	70(i)
1275	1342254758	10 Hygiea	-7.4	2012 Nov 09	05:28:31	321	B/R	H	1	20	3.0×10× 4	110(i)
41	1342179012	18 Melpomene	1.0	2009 Jun 24	04:49:31	2164	B/R	L	2	10	5.0×20×10	45(i)
132	1342184287	19 Fortuna	-10.7	2009 Sep 23	08:43:28	1855	B/R	H	4	20	5.0×10×30	45(i)
132	1342184288	19 Fortuna	-10.8	2009 Sep 23	09:14:54	1855	B/R	H	4	20	5.0×10×30	45(i)
221	1342188348	20 Massalia	-0.2	2009 Dec 21	04:55:50	289	B/R	H	1	20	4.0× 8× 4	63(i)
221	1342188349	20 Massalia	-0.2	2009 Dec 21	05:01:07	289	B/R	H	1	20	4.0× 8× 4	117(i)
221	1342188350	20 Massalia	-0.2	2009 Dec 21	05:06:24	289	G/R	H	1	20	4.0× 8× 4	63(i)
221	1342188351	20 Massalia	-0.2	2009 Dec 21	05:11:41	289	G/R	H	1	20	4.0× 8× 4	117(i)
792	1342224166	20 Massalia	17.9	2011 Jul 14	15:18:43	321	B/R	H	1	20	3.0×10× 4	70(i)
792	1342224167	20 Massalia	17.9	2011 Jul 14	15:24:32	321	B/R	H	1	20	3.0×10× 4	110(i)
792	1342224169	20 Massalia	17.9	2011 Jul 14	15:34:06	321	G/R	H	1	20	3.0×10× 4	70(i)
792	1342224170	20 Massalia	17.9	2011 Jul 14	15:39:55	321	G/R	H	1	20	3.0×10× 4	110(i)
1035	1342241348	20 Massalia	18.5	2012 Mar 13	21:24:31	321	B/R	H	1	20	3.0×10× 4	70(i)
1035	1342241349	20 Massalia	18.6	2012 Mar 13	21:30:20	321	B/R	H	1	20	3.0×10× 4	110(i)
1035	1342241351	20 Massalia	18.5	2012 Mar 13	21:39:54	321	G/R	H	1	20	3.0×10× 4	70(i)
1035	1342241352	20 Massalia	18.6	2012 Mar 13	21:45:43	321	G/R	H	1	20	3.0×10× 4	110(i)
1237	1342252018	20 Massalia	-1.1	2012 Oct 02	01:14:19	321	G/R	H	1	20	3.0×10× 4	70(i)
1237	1342252019	20 Massalia	-1.1	2012 Oct 02	01:20:08	321	G/R	H	1	20	3.0×10× 4	110(i)
1237	1342252021	20 Massalia	-1.1	2012 Oct 02	01:29:42	321	B/R	H	1	20	3.0×10× 4	70(i)

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Table 4: *continued*

			SAA	UTC Start time		Dur				S	Len×n×sep	ang.
OD	OBSID	Target	[°]	yyyy mon dd	hh:mm:ss	[s]	Fil	G	R	″/s	′×#×″	[°]
1237	1342252022	20 Massalia	-1.1	2012 Oct 02	01:35:31	321	B/R	H	1	20	3.0×10× 4	110(i)
221	1342188334	21 Lutetia	-8.5	2009 Dec 21	01:51:59	289	G/R	H	1	20	4.0× 8× 4	63(i)
221	1342188335	21 Lutetia	-8.5	2009 Dec 21	01:57:16	289	G/R	H	1	20	4.0× 8× 4	117(i)
221	1342188336	21 Lutetia	-8.5	2009 Dec 21	02:02:33	289	G/R	H	1	20	4.0× 8× 4	63(i)
221	1342188337	21 Lutetia	-8.5	2009 Dec 21	02:07:50	289	G/R	H	1	20	4.0× 8× 4	117(i)
400	1342198492	21 Lutetia	13.1	2010 Jun 17	17:06:20	321	G/R	H	1	20	3.0×10× 4	70(i)
400	1342198493	21 Lutetia	13.1	2010 Jun 17	17:12:09	321	G/R	H	1	20	3.0×10× 4	110(i)
400	1342198494	21 Lutetia	13.1	2010 Jun 17	17:17:58	321	B/R	H	1	20	3.0×10× 4	70(i)
400	1342198495	21 Lutetia	13.1	2010 Jun 17	17:23:47	321	B/R	H	1	20	3.0×10× 4	110(i)
684	1342217411	21 Lutetia	-0.7	2011 Mar 29	20:48:21	321	B/R	H	1	20	3.0×10× 4	70(i)
684	1342217412	21 Lutetia	-0.7	2011 Mar 29	20:54:10	321	B/R	H	1	20	3.0×10× 4	110(i)
684	1342217414	21 Lutetia	-0.7	2011 Mar 29	21:03:44	321	G/R	H	1	20	3.0×10× 4	70(i)
684	1342217415	21 Lutetia	-0.7	2011 Mar 29	21:09:33	289	G/R	H	1	20	3.0×10× 4	110(i)
859	1342228947	21 Lutetia	-13.2	2011 Sep 19	21:02:42	320	B/R	H	1	20	3.0×10× 4	70(i)
859	1342228948	21 Lutetia	-13.1	2011 Sep 19	21:08:32	321	B/R	H	1	20	3.0×10× 4	110(i)
859	1342228950	21 Lutetia	-13.1	2011 Sep 19	21:18:06	321	G/R	H	1	20	3.0×10× 4	70(i)
859	1342228951	21 Lutetia	-13.1	2011 Sep 19	21:23:54	320	G/R	H	1	20	3.0×10× 4	110(i)
1198	1342250104	21 Lutetia	23.9	2012 Aug 23	22:30:24	321	G/R	H	1	20	3.0×10× 4	70(i)
1198	1342250105	21 Lutetia	23.9	2012 Aug 23	22:36:13	321	G/R	H	1	20	3.0×10× 4	110(i)
1198	1342250107	21 Lutetia	23.9	2012 Aug 23	22:45:47	321	B/R	H	1	20	3.0×10× 4	70(i)
1198	1342250108	21 Lutetia	23.9	2012 Aug 23	22:51:36	321	B/R	H	1	20	3.0×10× 4	110(i)
1399	1342267261	21 Lutetia	-4.2	2013 Mar 13	02:01:18	321	G/R	H	1	20	3.0×10× 4	70(i)
1399	1342267262	21 Lutetia	-4.2	2013 Mar 13	02:07:07	321	G/R	H	1	20	3.0×10× 4	110(i)
1399	1342267264	21 Lutetia	-4.2	2013 Mar 13	02:16:41	321	B/R	H	1	20	3.0×10× 4	70(i)
1399	1342267265	21 Lutetia	-4.2	2013 Mar 13	02:22:30	321	B/R	H	1	20	3.0×10× 4	110(i)
497	1342205033	29 Amphitrite	-6.9	2010 Sep 22	21:27:14	320	B/R	H	1	20	3.0×10× 4	70(i)
497	1342205034	29 Amphitrite	-6.8	2010 Sep 22	21:33:04	321	B/R	H	1	20	3.0×10× 4	110(i)
497	1342205036	29 Amphitrite	-6.9	2010 Sep 22	21:42:37	320	G/R	H	1	20	3.0×10× 4	70(i)
497	1342205037	29 Amphitrite	-6.8	2010 Sep 22	21:48:26	320	G/R	H	1	20	3.0×10× 4	110(i)
245	1342189258	47 Aglaja	-19.5	2010 Jan 14	06:53:47	289	B/R	H	1	20	4.0× 8× 4	63(i)
245	1342189259	47 Aglaja	-19.5	2010 Jan 14	06:59:04	289	B/R	H	1	20	4.0× 8× 4	117(i)
245	1342189260	47 Aglaja	-19.4	2010 Jan 14	07:04:21	289	G/R	H	1	20	4.0× 8× 4	63(i)
245	1342189261	47 Aglaja	-19.5	2010 Jan 14	07:09:38	289	G/R	H	1	20	4.0× 8× 4	117(i)
512	1342206032	47 Aglaja	21.4	2010 Oct 07	19:21:03	321	B/R	H	1	20	3.0×10× 4	70(i)
512	1342206033	47 Aglaja	21.4	2010 Oct 07	19:26:52	321	B/R	H	1	20	3.0×10× 4	110(i)
512	1342206034	47 Aglaja	21.4	2010 Oct 07	19:32:41	321	G/R	H	1	20	3.0×10× 4	70(i)
512	1342206035	47 Aglaja	21.4	2010 Oct 07	19:38:30	321	G/R	H	1	20	3.0×10× 4	110(i)
286	1342191111	52 Europa	-16.0	2010 Feb 23	23:23:01	311	G/R	H	1	20	2.5×10× 4	70(i)
286	1342191112	52 Europa	-15.9	2010 Feb 23	23:28:40	311	G/R	H	1	20	2.5×10× 4	110(i)
286	1342191114	52 Europa	-16.0	2010 Feb 23	23:38:04	311	B/R	H	1	20	2.5×10× 4	70(i)
286	1342191115	52 Europa	-15.9	2010 Feb 23	23:43:43	311	B/R	H	1	20	2.5×10× 4	110(i)
613	1342212775	52 Europa	-13.7	2011 Jan 16	19:39:12	320	G/R	H	1	20	3.0×10× 4	70(i)
613	1342212776	52 Europa	-13.7	2011 Jan 16	19:45:01	320	G/R	H	1	20	3.0×10× 4	110(i)
613	1342212778	52 Europa	-13.7	2011 Jan 16	19:54:36	321	B/R	H	1	20	3.0×10× 4	70(i)
613	1342212779	52 Europa	-13.7	2011 Jan 16	20:00:24	320	B/R	H	1	20	3.0×10× 4	110(i)
771	1342223194	52 Europa	-1.4	2011 Jun 24	05:07:49	483	B/R	H	1	20	3.0×10× 4	70(i)
771	1342223195	52 Europa	-1.4	2011 Jun 24	05:14:58	320	B/R	H	1	20	3.0×10× 4	110(i)
771	1342223196	52 Europa	-1.5	2011 Jun 24	05:20:47	320	G/R	H	1	20	3.0×10× 4	70(i)
771	1342223197	52 Europa	-1.4	2011 Jun 24	05:26:36	320	G/R	H	1	20	3.0×10× 4	110(i)
1007	1342239464	52 Europa	24.5	2012 Feb 14	22:39:12	321	G/R	H	1	20	3.0×10× 4	70(i)
1007	1342239465	52 Europa	24.5	2012 Feb 14	22:45:01	321	G/R	H	1	20	3.0×10× 4	110(i)
1007	1342239467	52 Europa	24.4	2012 Feb 14	22:54:35	321	B/R	H	1	20	3.0×10× 4	70(i)
1007	1342239468	52 Europa	24.5	2012 Feb 14	23:00:24	321	B/R	H	1	20	3.0×10× 4	110(i)
1216	1342250875	52 Europa	0.7	2012 Sep 11	05:34:02	320	G/R	H	1	20	3.0×10× 4	70(i)
1216	1342250876	52 Europa	0.7	2012 Sep 11	05:39:51	320	G/R	H	1	20	3.0×10× 4	110(i)
1216	1342250878	52 Europa	0.7	2012 Sep 11	05:49:25	320	B/R	H	1	20	3.0×10× 4	70(i)
1216	1342250879	52 Europa	0.7	2012 Sep 11	05:55:14	320	B/R	H	1	20	3.0×10× 4	110(i)
1442	1342270732	52 Europa	20.6	2013 Apr 24	15:00:59	321	G/R	H	1	20	3.0×10× 4	70(i)
1442	1342270733	52 Europa	20.6	2013 Apr 24	15:06:48	321	G/R	H	1	20	3.0×10× 4	110(i)
1442	1342270735	52 Europa	20.6	2013 Apr 24	15:16:22	321	B/R	H	1	20	3.0×10× 4	70(i)
1442	1342270736	52 Europa	20.6	2013 Apr 24	15:22:11	321	B/R	H	1	20	3.0×10× 4	110(i)
400	1342198509	54 Alexandra	4.0	2010 Jun 17	19:32:32	321	B/R	H	1	20	3.0×10× 4	70(i)
400	1342198510	54 Alexandra	4.1	2010 Jun 17	19:38:21	321	B/R	H	1	20	3.0×10× 4	110(i)
400	1342198511	54 Alexandra	4.0	2010 Jun 17	19:44:10	321	G/R	H	1	20	3.0×10× 4	70(i)
400	1342198512	54 Alexandra	4.1	2010 Jun 17	19:49:59	321	G/R	H	1	20	3.0×10× 4	110(i)
221	1342188354	65 Cybele	14.2	2009 Dec 21	05:26:52	289	B/R	H	1	20	4.0× 8× 4	63(i)
221	1342188355	65 Cybele	14.2	2009 Dec 21	05:32:09	289	B/R	H	1	20	4.0× 8× 4	117(i)
221	1342188356	65 Cybele	14.2	2009 Dec 21	05:37:26	289	G/R	H	1	20	4.0× 8× 4	63(i)
221	1342188357	65 Cybele	14.2	2009 Dec 21	05:42:43	289	G/R	H	1	20	4.0× 8× 4	117(i)
456	1342202949	65 Cybele	1.1	2010 Aug 12	21:35:48	321	B/R	H	1	20	3.0×10× 4	70(i)
456	1342202950	65 Cybele	1.2	2010 Aug 12	21:41:37	321	B/R	H	1	20	3.0×10× 4	110(i)
456	1342202951	65 Cybele	1.1	2010 Aug 12	21:47:26	321	G/R	H	1	20	3.0×10× 4	70(i)
456	1342202952	65 Cybele	1.1	2010 Aug 12	21:53:15	321	G/R	H	1	20	3.0×10× 4	110(i)
662	1342215368	65 Cybele	28.1	2011 Mar 06	20:54:09	289	B/R	H	1	20	3.0×10× 4	70(i)
662	1342215369	65 Cybele	28.2	2011 Mar 06	20:59:58	321	B/R	H	1	20	3.0×10× 4	110(i)
662	1342215371	65 Cybele	28.2	2011 Mar 06	21:09:32	321	G/R	H	1	20	3.0×10× 4	70(i)
662	1342215372	65 Cybele	28.2	2011 Mar 06	21:15:21	321	G/R	H	1	20	3.0×10× 4	110(i)
469	1342203465	88 Thisbe	20.5	2010 Aug 25	17:30:11	321	G/R	H	1	20	3.0×10× 4	70(i)
469	1342203466	88 Thisbe	20.5	2010 Aug 25	17:36:00	321	G/R	H	1	20	3.0×10× 4	110(i)
469	1342203467	88 Thisbe	20.5	2010 Aug 25	17:41:49	321	B/R	H	1	20	3.0×10× 4	70(i)
469	1342203468	88 Thisbe	20.5	2010 Aug 25	17:47:38	321	B/R	H	1	20	3.0×10× 4	110(i)

continued on next page

Table 4: *continued*

OD	OBSID	Target	SAA [°]	UTC Start time yyyy mon dd	hh:mm:ss	Dur [s]	Fil	G	R	S ″/s	Len×n×sep ′×#×″	ang. [°]
947	1342234461	88 Thisbe	-13.6	2011 Dec 16	23:38:22	321	B/R	H	1	20	3.0×10× 4	70(i)
947	1342234462	88 Thisbe	-13.6	2011 Dec 16	23:44:11	321	B/R	H	1	20	3.0×10× 4	110(i)
947	1342234464	88 Thisbe	-13.7	2011 Dec 16	23:53:45	321	G/R	H	1	20	3.0×10× 4	70(i)
947	1342234465	88 Thisbe	-13.6	2011 Dec 16	23:59:34	321	G/R	H	1	20	3.0×10× 4	110(i)
1110	1342246230	88 Thisbe	7.2	2012 May 28	06:30:12	321	G/R	H	1	20	3.0×10× 4	70(i)
1110	1342246231	88 Thisbe	7.2	2012 May 28	06:36:01	321	G/R	H	1	20	3.0×10× 4	110(i)
1110	1342246233	88 Thisbe	7.2	2012 May 28	06:45:35	321	B/R	H	1	20	3.0×10× 4	70(i)
1110	1342246234	88 Thisbe	7.2	2012 May 28	06:51:24	321	B/R	H	1	20	3.0×10× 4	110(i)
1346	1342261458	88 Thisbe	24.0	2013 Jan 19	00:23:12	321	G/R	H	1	20	3.0×10× 4	70(i)
1346	1342261459	88 Thisbe	24.0	2013 Jan 19	00:29:01	321	G/R	H	1	20	3.0×10× 4	110(i)
1346	1342261461	88 Thisbe	24.0	2013 Jan 19	00:38:35	321	B/R	H	1	20	3.0×10× 4	70(i)
1346	1342261462	88 Thisbe	24.0	2013 Jan 19	00:44:24	321	B/R	H	1	20	3.0×10× 4	110(i)
484	1342204236	93 Minerva	22.7	2010 Sep 09	20:22:46	321	G/R	H	1	20	3.0×10× 4	70(i)
484	1342204237	93 Minerva	22.7	2010 Sep 09	20:28:35	321	G/R	H	1	20	3.0×10× 4	110(i)
484	1342204238	93 Minerva	22.7	2010 Sep 09	20:34:24	321	B/R	H	1	20	3.0×10× 4	70(i)
484	1342204239	93 Minerva	22.7	2010 Sep 09	20:40:13	321	B/R	H	1	20	3.0×10× 4	110(i)
493	1342204869	253 Mathilde[2]	-18.0	2010 Sep 19	16:15:50	152	B/R	H	1	20	3.0× 4× 4	110(i)
493	1342204870	253 Mathilde[2]	-18.0	2010 Sep 19	16:18:51	152	B/R	H	1	20	3.0× 4× 4	70(i)
493	1342204871	253 Mathilde[2]	-18.0	2010 Sep 19	16:21:52	152	G/R	H	1	20	3.0× 4× 4	70(i)
493	1342204872	253 Mathilde[2]	-18.0	2010 Sep 19	16:24:53	152	G/R	H	1	20	3.0× 4× 4	110(i)
285	1342191020	423 Diotima	5.7	2010 Feb 23	10:04:17	311	B/R	H	1	20	2.5×10× 4	70(i)
285	1342191021	423 Diotima	5.8	2010 Feb 23	10:09:56	311	B/R	H	1	20	2.5×10× 4	110(i)
285	1342191023	423 Diotima	5.7	2010 Feb 23	10:19:20	311	G/R	H	1	20	2.5×10× 4	70(i)
285	1342191024	423 Diotima	5.8	2010 Feb 23	10:24:59	311	G/R	H	1	20	2.5×10× 4	110(i)
686	1342217773	511 Davida	-0.3	2011 Mar 31	12:13:30	467	B/R	H	1	20	3.0×10× 4	70(i)
686	1342217774	511 Davida	-0.3	2011 Mar 31	12:20:32	321	B/R	H	1	20	3.0×10× 4	110(i)
686	1342217775	511 Davida	-0.3	2011 Mar 31	12:26:21	321	G/R	H	1	20	3.0×10× 4	70(i)
686	1342217776	511 Davida	-0.3	2011 Mar 31	12:32:10	321	G/R	H	1	20	3.0×10× 4	110(i)
446	1342202081	704 Interamnia	0.6	2010 Aug 02	18:49:03	320	B/R	H	1	20	3.0×10× 4	70(i)
446	1342202082	704 Interamnia	0.6	2010 Aug 02	18:54:53	321	B/R	H	1	20	3.0×10× 4	110(i)
446	1342202083	704 Interamnia	0.6	2010 Aug 02	19:00:41	320	G/R	H	1	20	3.0×10× 4	70(i)
446	1342202084	704 Interamnia	0.6	2010 Aug 02	19:06:31	321	G/R	H	1	20	3.0×10× 4	110(i)
703	1342218739	704 Interamnia	-3.0	2011 Apr 17	13:25:20	842	B/R	H	1	20	3.0×10× 4	70(i)
703	1342218740	704 Interamnia	0.9	2011 Apr 17	13:35:29	320	B/R	H	1	20	3.0×10× 4	110(i)
703	1342218741	704 Interamnia	0.9	2011 Apr 17	13:41:19	321	G/R	H	1	20	3.0×10× 4	70(i)
703	1342218742	704 Interamnia	0.9	2011 Apr 17	13:47:07	320	G/R	H	1	20	3.0×10× 4	110(i)
887	1342231106	704 Interamnia	2.2	2011 Oct 18	10:01:37	321	B/R	H	1	20	3.0×10× 4	70(i)
887	1342231107	704 Interamnia	2.2	2011 Oct 18	10:07:25	320	B/R	H	1	20	3.0×10× 4	110(i)
887	1342231109	704 Interamnia	2.2	2011 Oct 18	10:16:59	320	G/R	H	1	20	3.0×10× 4	70(i)
887	1342231110	704 Interamnia	2.2	2011 Oct 18	10:22:49	321	G/R	H	1	20	3.0×10× 4	110(i)
1146	1342247641	704 Interamnia	27.5	2012 Jul 02	23:21:37	321	G/R	H	1	20	3.0×10× 4	70(i)
1146	1342247642	704 Interamnia	27.6	2012 Jul 02	23:27:26	321	G/R	H	1	20	3.0×10× 4	110(i)
1146	1342247644	704 Interamnia	27.5	2012 Jul 02	23:37:00	321	B/R	H	1	20	3.0×10× 4	70(i)
1146	1342247645	704 Interamnia	27.6	2012 Jul 02	23:42:48	320	B/R	H	1	20	3.0×10× 4	110(i)
1351	1342261950	704 Interamnia	-13.9	2013 Jan 23	23:40:36	320	G/R	H	1	20	3.0×10× 4	70(i)
1351	1342261951	704 Interamnia	-13.9	2013 Jan 23	23:46:25	320	G/R	H	1	20	3.0×10× 4	110(i)
1351	1342261953	704 Interamnia	-13.9	2013 Jan 23	23:55:59	320	B/R	H	1	20	3.0×10× 4	70(i)
1351	1342261954	704 Interamnia	-13.9	2013 Jan 24	00:01:48	320	B/R	H	1	20	3.0×10× 4	110(i)
1442	1342270750[5]	2000 Herschel[3]	-1.5	2013 Apr 25	02:25:13	356	B/R	H	1	20	3.0×10× 4	70(i)
1201	1342250354	2867 Steins[2]	-20.3	2012 Aug 27	14:35:35	398	B/R	H	1	20	3.0×10× 4	70(i)
1201	1342250355	2867 Steins[2]	-20.3	2012 Aug 27	14:42:03	321	B/R	H	1	20	3.0×10× 4	110(i)
1201	1342250356	2867 Steins[2]	-20.3	2012 Aug 27	14:54:55	1167	G/R	H	4	20	3.0×10× 4	70(i)
1201	1342250357	2867 Steins[2]	-20.4	2012 Aug 27	15:14:50	1167	G/R	H	4	20	3.0×10× 4	110(i)

Notes.
(1) DDT_dbockele_3; (2) GT1_lorourke_9; (3) DDT_fhormuth_1
(4) fixed observations (no SSO tracking): αTau and 4 Vesta in the same field.
(5) observation started, but no science data taken