Deliverable

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

Topic: COMPET-05-2015 - Scientific exploitation of astrophysics, comets, and planetary data
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WP5 Ground based observations
Objectives: To obtain auxiliary ground-based observations for the SBNAF sample objects: time series (lightcurves), astrometric measurements, stellar occultations and absolute photometry.

Description of deliverable

This deliverable is an update of the list of works (published or in preparation) included in deliverable D5.6. These works are related to each observational technique within the SBNAF project, all of them include the SBNAF grant acknowledgement and (most of them) are publically available via arXiv. Some of the works are repeated within different observational techniques because they include relevant results related with various techniques. The current list will be updated in the subsequent deliverable: D5.8-'Observational publications 3'. The description of the different observational techniques used to obtain auxiliary data of the SBNAF targets and the applications of all these observational data was done in D5.6, so here we just refer to this deliverable when necessary.

Contents

1 Time series observations

Time series observations allow obtaining the brightness variability of any target with time. For solar system atmosphereless objects this brightness variability is directly related to the rotation of the body and can be due to an irregular object shape or to regions with different surface albedo. From these time series observations it is possible to derive the rotational period of the object and the amplitude of the lightcurve. The combination of many high-quality, densely sampled lightcurves obtained at different epochs will lead to shape and spin-vector solutions for the object. In the framework of the solar system minor bodies these time series are usually referred as rotational lightcurves, or simply 'lightcurves'. This technique is working for NEAs, MBAs, Centaurs and TNOs (see Fig. 1, Müller et al. 2017). The description and applications of this technique is detailed in deliverable D5.6.

1.1 List of related works

List of works related to time series measurements acquired in the SBNAF context at date 7-April-2018. A brief list of SBNAF-related measurements is included for each work (other publicly available data sets not related to SBNAF are often used within these publications). Updates respect to deliverable D5.6 -'Observational publications' are marked in boldface.

- Large Halloween Asteroid at Lunar Distance, by Müller et al. 2016, A&A 598, A63
    - *3-band mid-infrared observations with ESO VLT/VISIR*
    - *Multi-epoch optical lightcurve observations from several ground-based observatories (CAHA, OSN, La Hita)*
    - *Absolute magnitudes in V and R-bands*
- 2008 OG19: a highly elongated Trans-Neptunian object, by Fernandez-Valenzuela et al. 2016, MNRAS 456, 2354
    - *Multi-epoch optical lightcurve observations from several ground-based observatories (CAHA, OSN)*
    - *Absolute magnitude in R-band*
- Nereid from space: rotation, size and shape analysis from K2, Herschel and Spitzer observations, by Kiss et al. 2016, MNRAS 457, 2908
    - *Long-term optical lightcurve observations from K2, Campaign 3*
    - *Astrometric K2 measurements*
- The heart of the swarm: K2 photometry and rotational characteristics of 56 Jovian Trojan asteroids, by Szabó et al. 2017, A&A, 599, A44
    - *Long-term optical lightcurve observations from K2, Campaign 6*
    - *Astrometric K2 measurements*
- Uninterrupted optical lightcurves of main-belt asteroids from the K2 Mission, by Szabó et al. 2016, A&A, 596, A40
    - *Long-term optical lightcurve observations from K2*
    - *Astrometric K2 measurements*
- Large Size and Slow Rotation of the Trans-Neptunian Object (225088) 2007 OR10 Discovered from Herschel and K2 Observations, by Pál et al. 2016, AJ 151, 117

- *Long-term optical lightcurve observations from K2*
- *Astrometric K2 measurements*

- Physical properties of centaur (54598) Bienor from photometry, by Fernandez-Valenzuela et al. 2017, **MNRAS 466, 4147F**
  - *Multi-epoch optical lightcurve observations from several ground-based observatories (CAHA, OSN, NOT)*
  - *Absolute magnitude in V and R-bands*

- Hayabusa-2 Mission Target Asteroid 162173 Ryugu (1999 JU3): Searching for the Object's Spin-Axis Orientation, by Müller et al. 2016, A&A 599, A103
  - *Optical observations from ESO La Silla MPI 2.2m / GROND*
- Spectral and rotational properties of near-Earth asteroid (162173) Ryugu, target of the Hayabusa2 sample return mission, by Perna et al. 2017, A&A 599, L1
  - *Optical lightcurve observations with ESO VLT/VISIR*
  - *Absolute magnitude in V-band*
- "TNOs are Cool": A Survey of the Transneptunian Region. XII. Thermal lightcurves of Haumea, 2003 VS2 and 2003 AZ84 with Herschel Space Observatory-PACS, by Santos-Sanz et al. **2017, A&A, , 604, A95**
  - *Thermal lightcurve observations with Herschel/PACS*
  - *Multi-epoch optical lightcurve observations from several ground-based observatories (CAHA, OSN)*
- **Shape Models and Physical Properties of Asteroids, by Santana-Ros et al. 2017, Assessment and Mitigation of Asteroid Impact Hazards, Astrophysics and Space Science Proceedings, Volume 46**
  - ***Multi-epoch optical lightcurve observations from several ground-based observatories***
  - ***Summary of stellar occultation measurements from several locations, some of them SBNAF-related***
- **Shape and spin distributions of asteroid populations from brightness variation estimates and large databases, by Nortunen et al. 2017, A&A, 601, A139**
  - ***Thermal lightcurve observations with WISE***
  - ***Multi-epoch optical lightcurve observations from several ground-based observatories***
- **Asteroid shapes and thermal properties from combined optical and mid-infrared photometry inversion, Ďurech et al. 2017, A&A, 604, 27D**
  - ***Thermal observations with WISE***
  - ***Multi-epoch optical lightcurve observations from several ground-based observatories***
- **3-D shape of asteroid (6) Hebe from VLT/SPHERE imaging: Implications for the origin of ordinary H chondrites, Marsset et al. 2017, A&A, 604, A64**
  - ***Multi-epoch optical lightcurve observations from several ground-based observatories***
  - ***Adaptive Optics observations with ESO VLT/SPHERE***
- **The EURONEAR Lightcurve Survey of Near Earth Asteroids, by Vaduvescu et al. 2017, EM&P, 120, 41**

- *Multi-epoch optical lightcurve observations from several ground-based observatories*

- **Statistical analysis of the ambiguities in the asteroid period determinations, by Butkiewicz-Bąk et al. 2017, MNRAS, 470, 1314**
  - *Extensive simulations to assess the reliability of spin periods obtained on lightcurve data from various observing geometries*
- **Properties of the irregular satellite system around Uranus inferred from K2, Herschel and Spitzer observations, by Farkas-Takács et al. 2017, AJ, 154, 119**
  - *Long-term optical lightcurve observations from K2*
  - *Astrometric K2 measurements*
- **A new non-convex model of the binary asteroid (809) Lundia obtained with the SAGE modelling technique, by Bartczak et al. 2017, MNRAS, 471, 941**
  - *Multi-epoch optical lightcurve observations from several ground-based observatories*
- **Spin states of asteroids in the Eos collisional family, by Hanuš et al. 2018, Icarus 299, 84H**
  - *Multi-epoch optical lightcurve observations from several ground-based observatories*
  - *Thermal lightcurve observations with Keck II telescope/Nirc2*
- **Shaping asteroid models using genetic evolution (SAGE), by Bartczak & G. Dudziński 2018, MNRAS 473, 5050B**
  - *Multi-epoch optical lightcurve observations from several ground-based observatories*
- **Photometric survey, modelling, and scaling of long-period and low-amplitude asteroids, by Marciniak et al. 2018, A&A 610, A7**
  - *Multi-epoch optical lightcurve observations from several ground-based observatories*
  - *Thermal lightcurve observations from IRAS, AKARI, WISE*
- **Main-belt Asteroids in the K2 Uranus Field, by Molnár et al. 2018, ApJS 234, 37M**
  - *Long-term optical lightcurve observations from K2*
  - *Astrometric K2 measurements*
- **Activity of (2060) Chiron possibly caused by impacts?, by Cikota et al. 2018, MNRAS 475, 2512-2518**
  - *Multi-epoch optical lightcurve observations from 3 telescopes at CAHA*
  - *Absolute magnitude in V and R-bands*
- **Thermal infrared and optical photometry of Asteroidal Comet C/2002 CE10, by Sekiguchi et al. 2018, Icarus 304, 95-100**
  - *Optical observations with the 1.05m telescope at Kiso Observatory (Japan)*
  - *Thermal observations with the 3.6m telescope at La Silla (ESO, Chile)*
  - *Absolute magnitude in V-band*
- **PRIMASS visits the Hilda and Cybele groups, by De Prá et al. 2017, accepted by Icarus**
  - *Visual+near-infrared spectrum from different telescopes*
  - *Absolute magnitudes in V-band*

- **Small Bodies Near and Far (SBNAF): a benchmark study on physical and thermal properties of small bodies in the Solar System, Müller et al. 2017, accepted by Advances in Space Research**
    - ***Multi-epoch optical lightcurve observations from several ground-based observatories***
    - ***Thermal observations with Herschel***
    - ***Long-term optical lightcurve observations from K2***
    - ***Astrometric K2 measurements***
    - ***Stellar occultation measurements from several locations***

- Several other publications related to this technique are in preparation.

It is important to note that part of the SBNAF observational data on which are based these (and next chapters) publications are accessible via CDS[1] database.

2 Astrometric measurements

Astrometric measurements are the measurements of the positions in the sky (Right Ascension and Declination coordinates) of any astronomical source. In the particular case of solar system moving objects these coordinates only can be obtained from relative comparison with star catalogue coordinates located in the same Field of View (FOV) where the object is. That is also applicable for any other astronomical source not included in astrometric catalogues. For a more detailed description and applications of this technique see deliverable D5.6.

2.1 List of related works

List of works related to astrometric measurements acquired in the SBNAF context at date 7-April-2018. A brief list of SBNAF-related measurements is included for each work (other publicly available data sets not related to SBNAF are often used within these publications). Updates respect to deliverable D5.6 - 'Observational publications' are marked in boldface.

- Discovery of a satellite of the large trans-Neptunian object (225088) 2007 OR10, by Kiss et al. 2017, ApJL, **838, L1**
    - *Astrometric HST measurements*
- Nereid from space: rotation, size and shape analysis from K2, Herschel and Spitzer observations, by Kiss et al. 2016, MNRAS 457, 2908
    - *Long-term optical lightcurve observations from K2, Campaign 3*
    - *Astrometric K2 measurements*
- The heart of the swarm: K2 photometry and rotational characteristics of 56 Jovian Trojan asteroids, by Szabó et al. 2017, A&A, 599, A44
    - *Long-term optical lightcurve observations from K2, Campaign 6*
    - *Astrometric K2 measurements*

[1] CDS: Centre de Données astronomiques de Strasbourg: http://cdsweb.u-strasbg.fr/

- Uninterrupted optical lightcurves of main-belt asteroids from the K2 Mission, by Szabó et al. 2016, A&A, 596, A40
    - *Long-term optical lightcurve observations from K2*
    - *Astrometric K2 measurements*
- Large Size and Slow Rotation of the Trans-Neptunian Object (225088) 2007 OR10 Discovered from Herschel and K2 Observations, by Pál et al. 2016, AJ 151, 117
    - *Long-term optical lightcurve observations from K2*
    - *Astrometric K2 measurements*
- **Properties of the irregular satellite system around Uranus inferred from K2, Herschel and Spitzer observations, Farkas-Takács et al. 2017, AJ, 154, 119**
    - ***Long-term optical lightcurve observations from K2***
    - ***Astrometric K2 measurements***
- **Main-belt Asteroids in the K2 Uranus Field, Molnár et al. 2018, ApJS 234, 37M**
    - ***Long-term optical lightcurve observations from K2***
    - ***Astrometric K2 measurements***

- **Astrometry derived from stellar occultations obtained within the SBNAF project have been recently submitted to the Minor Planet Center (MPC[2]) by Dave Herald[3] and has been published in the Minor Planet Circulars[4] for the SBNAF related objects: 8, 18, 19, 44, 173, 372, 501, 54598 and 136108. Astrometric positions derived from occultations are very accurate and they are used to significantly improve the orbit calculation for these objects. This allows a better prediction of stellar occultations by these bodies.**

- **Very extensive observing campaigns from different telescopes at Spain, Argentina and Chile (Sierra Nevada, Calar Alto, La Hita, Roque de los Muchachos, ASH1, ASH2, etc) to predict the stellar occultation by the dwarf planet Haumea, by the centaurs 2002 GZ32 and Bienor, by the TNO 2002 TC302, and by others TNOs/Centaurs.**

- See also the list of related works for the stellar occultation technique where astrometric measurements are, directly or indirectly, always used (Section 3.1).

- Several other publications related to this technique are in preparation.

[2] MPC: Minor Planet Center http://www.minorplanetcenter.net/iau/mpc.html

[3] **D. Herald**, 3 Lupin Pl., Murrumbateman, NSW 2582, Australia. **Measurers**: D. Herald, E. Frappa, T. Hayamizu, S. Kerr, B. Timerson

[4] These measurements were published in 'The MINOR PLANET CIRCULARS/MINOR PLANETS AND COMETS SUPPLEMENT'. The astrometry is published in order of asteroid number, then the first object appears on Circular 878942– with observatory code 244. https://www.minorplanetcenter.net/iau/ECS/MPCArchive/2018/MPS_20180331.pdf

3 Stellar occultations

The stellar occultation technique is a very direct way to derive sizes and projected shapes of small bodies. First it is needed to predict when the body will pass in front of a star and then simply measuring the flux of the star before, during and after the occultation from a few locations within the predicted shadow path. It provides area-equivalent diameters with kilometric accuracy from which it is possible to derive the geometric albedo of the surface of the object. This technique can reveal the presence of atmospheres, discover and characterize satellites, rings or any other material orbiting around the object. The stellar occultation technique is well developed for planets, satellites and MBAs, but it is only an emerging and very new field for TNOs and Centaurs. Predicting and observing stellar occultations by TNOs is extremely difficult and challenging because the angular diameters of TNOs are very small and neither the stellar catalogues nor the TNOs orbits have the accuracy required to make reliable predictions well in advance. The description and applications of this technique is detailed in deliverable D5.6.

3.1 List of related works

List of works related to stellar occultation measurements obtained within the SBNAF project at date 7-April-2018. A brief list of SBNAF-related measurements is included for each work (other publicly available data sets not related to SBNAF are often used within these publications). Updates respect to deliverable D5.6 - 'Observational publications' are marked in boldface.

- D5.1 Occultation candidates for 2016
    - *Astrometric measurements from different ground-based observatories (OSN, CAHA, La Hita, ORM, ASH1, ASH2, etc)*
    - *Occultation predictions based on different stellar catalogues and orbits*
- D5.2 Occultation candidates for 2017
    - *Astrometric measurements from different ground-based observatories (OSN, CAHA, La Hita, ORM, ASH1, ASH2, etc)*
    - *Occultation predictions based on different stellar catalogues and orbits*
- **D5.3 Occultation candidates for 2018**
    - ***Astrometric measurements from different ground-based observatories (OSN, CAHA, La Hita, ORM, ASH1, ASH2, etc)***
    - ***Occultation predictions based on different stellar catalogues and orbits***
- Results from the 2014 November 15th multi-chord stellar occultation by the TNO (229762) 2007 UK126, by Benedetti-Rossi et al. 2016, AJ 152, 156
    - *Astrometric measurements from different ground-based observatories (OSN, CAHA, La Hita, ORM, ASH1, ASH2, etc)*
    - *Stellar occultation measurements from several locations*

- Results from a triple chord stellar occultation and far-infrared photometry of the trans-Neptunian object (229762) 2007 UK126, by Schindler et al. 2016, A&A accepted (ADS & arXiv:1611.02798)
  - *Astrometric measurements from different ground-based observatories (OSN, CAHA, La Hita, ORM, ASH1, ASH2)*
  - *Stellar occultation measurements from several locations*
- James Webb Space Telescope Observations of Stellar Occultations by Solar System Bodies and Rings, by Santos-Sanz et al. 2016, PASP 128, 8011S
  - *Summary of Stellar occultation measurements from several locations, some of them SBNAF-related*
- **Shape Models and Physical Properties of Asteroids, by Santana-Ros et al. 2017, Assessment and Mitigation of Asteroid Impact Hazards, Astrophysics and Space Science Proceedings, Volume 46**
  - ***Multi-epoch optical lightcurve observations from several ground-based observatories***
  - ***Summary of stellar occultation measurements from several locations***
- **Assessment of different formation scenarios for the ring system of (10199) Chariklo, by Melita et al. 2017, A&A, 602, A27**
  - ***Stellar occultation measurements of the rings of Chariklo from several locations***
- **Study of the Plutino Object (208996) 2003 AZ84 from Stellar Occultations: Size, Shape, and Topographic Features, by Dias-Oliveira et al. 2017, AJ 154, 22D**
  - ***Astrometric measurements from different ground-based observatories (OSN, CAHA, La Hita, ORM, ASH1, ASH2)***
  - ***Stellar occultation measurements from several locations***
- **The size, shape, density and ring of the dwarf planet Haumea from a stellar occultation, Ortiz et al. 2017, Nature 550, 219-223**
  - ***Astrometric measurements from different ground-based observatories (OSN, CAHA, La Hita, ORM, ASH1, ASH2)***
  - ***Stellar occultation measurements from several locations***
- **The structure of Chariklo's rings from stellar occultations, by Bérard et al. 2017, AJ 154, 144, 21pp**
  - ***Astrometric measurements from different ground-based observatories (OSN, CAHA, La Hita, ORM, ASH1, ASH2)***
  - ***Stellar occultation measurements from several locations***
- **Size and shape of Chariklo and its rings reflectivity from multi-epoch stellar occultations, by Leiva et al. 2017, AJ 154, 159, 23pp**
  - ***Astrometric measurements from different ground-based observatories (OSN, CAHA, La Hita, ORM, ASH1, ASH2)***
  - ***Stellar occultation measurements from several locations***

- Several other publications related to this technique are in preparation (e.g. Stellar occultations by the TNOs 2003VS2, 2014MU69 and 2002TC302, by the Centaur 2002 GZ32, etc).

4 Absolute photometry

The absolute photometry technique is dedicated to obtain absolute magnitudes in any of the standard photometric systems (e.g. as the Johnson-Morgan or UBV photometric system which is the most useful one, Johnson & Morgan 1953). In the particular case of solar system objects the absolute magnitude is, by definition, the apparent magnitude of the object when it is located at 1 AU from the Sun and from the observer at any particular filter. Consult deliverable D5.6 for a detailed description and applications of this technique.

4.3 List of related works

List of works related to absolute photometry measurements in the SBNAF context at date 7-April-2018. A brief list of SBNAF-related measurements is included for each work (other publicly available data sets not related to SBNAF are often used within these publications). Updates respect to deliverable D5.6 - 'Observational publications' are marked in boldface.

- Large Halloween Asteroid at Lunar Distance, by Müller et al. 2016, A&A 598, A63
    - *3-band mid-infrared observations with ESO VLT/VISIR*
    - *Multi-epoch optical lightcurve observations from several ground-based observatories (CAHA, OSN, La Hita)*
    - *Absolute magnitude in V and R-bands*
- 2008 OG19: a highly elongated Trans-Neptunian object, by Fernandez-Valenzuela et al. 2016, MNRAS 456, 2354
    - *Multi-epoch optical lightcurve observations from several ground-based observatories (CAHA, OSN)*
    - *Absolute magnitude in R-band*
- Physical properties of centaur (54598) Bienor from photometry, by Fernandez-Valenzuela et al. 2016, **MNRAS 466, 4147F**
    - *Multi-epoch optical lightcurve observations from several ground-based observatories (CAHA, OSN, NOT)*
    - *Absolute magnitude in V and R-bands*
- Spectral and rotational properties of near-Earth asteroid (162173) Ryugu, target of the Hayabusa2 sample return mission, by Perna et al. 2017, A&A 599, L1
    - *Optical lightcurve observations with ESO VLT/VISIR*
    - *Absolute magnitude in V-band*
- **Activity of (2060) Chiron possibly caused by impacts?, by Cikota et al. 2018, MNRAS 475, 2512-2518**
    - ***Multi-epoch optical lightcurve observations from 3 telescopes at CAHA***
    - ***Absolute magnitude in V and R-bands***
- **Thermal infrared and optical photometry of Asteroidal Comet C/2002 CE10, Sekiguchi et al. 2018, Icarus 304, 95-100**
    - ***Optical observations with the 1.05m telescope at Kiso Observatory (Japan)***

    - ***Thermal observations with the 3.6m telescope at La Silla (ESO, Chile)***
    - ***Absolute magnitude in V-band***
- **Surface ice and Tholins on the extreme Centaur 2012 DR30, Szabó et al. 2018, AJ 155, 170, 8pp**
    - ***Optical long term observations from different telescopes***
    - ***Visual+near-infrared spectrum with the SOAR and Magellan telescopes***
    - ***Absolute magnitude in V-band***
- **PRIMASS visits the Hilda and Cybele groups, De Prá, et al. 2018, accepted by Icarus in November 2017**
    - ***Visual+near-infrared spectrum from different telescopes***
    - ***Absolute magnitudes in V-band***
- **All the works related with stellar occultations (see section 3.1) include absolute magnitudes estimations needed to compute the geometric albedos of the surface.**
- **Most of the works related with thermal or thermo-physical modeling of thermal data also include absolute magnitude estimations as a necessary input parameter to run the models.**

- Several other publications related to this technique are in preparation.

5 Thermal data

Thermal data are the measurement of the thermal emission of an object (in contraposition to the measurement of its reflected light). Thermal emission of closer small bodies (NEAs/MBAs) can be well detected at near/mid-infrared (~4-21 μm, with peak ~ 10-20 μm). For distant objects (e.g. Centaurs/TNOs) far-infrared wavelengths are more adequate to measure their thermal emission (~25-500 μm, with peak ~ 70-160 μm). The description and applications of this technique is detailed in deliverable D5.6.

5.1 List of related works

List of works related to thermal measurements in the SBNAF context at date 7-April-2018. A brief list of SBNAF-related measurements is included for each work (other publicly available data sets not related to SBNAF are often used within these publications). The thermal data used/mentioned in the various works will also be included in our IR database which is currently filled with all kind of thermal measurements (for more details about our IR database see presentation in the upcoming Granada meeting). Updates respect to deliverable D5.6 -'Observational publications' are marked in boldface.

- D2.5 IR database (internal, in preparation)
- D2.6 IR database (public, in preparation)
- Large Halloween Asteroid at Lunar Distance, by Müller et al. 2016, A&A 598, A63

- *3-band mid-infrared observations with ESO VLT/VISIR*
- *Multi-epoch optical lightcurve observations from several ground-based observatories (CAHA, OSN, La Hita)*
- *Absolute magnitudes in V and R-bands*

- **Thermal Infrared Imaging Experiments of C-Type Asteroid 162173 Ryugu on Hayabusa2, by Okada et al. 2017, Space Science Reviews 208, 255-286**
  - ***Description of the thermal infrared imager TIR onboard Hayabusa2 that will obtain thermal data of asteroid 162173 Ryugu***
- **Sizes and albedos of Mars-crossing asteroids from WISE/NEOWISE data, by Alí-Lagoa & Delbo, A&A 603, 55A**
  - ***Thermal observations with WISE/NEOWISE***
  - ***Absolute magnitudes***
- **Asteroid shapes and thermal properties from combined optical and mid-infrared photometry inversion, Ďurech et al. 2017, A&A 604, 27D**
  - ***Thermal observations with WISE***
  - ***Multi-epoch optical lightcurve observations from several ground-based observatories***
  - ***Absolute magnitudes***
- **"TNOs are Cool": A survey of the trans-Neptunian region. XII. Thermal light curves of Haumea, 2003 VS2 and 2003 AZ84 with Herschel/PACS", by Santos-Sanz et al. 2017, A&A, 604, A95**
  - ***Thermal observations with Herschel/PACS***
  - ***Multi-epoch optical lightcurve observations from several ground-based observatories***
  - ***Absolute magnitudes in V-band***
- **"TNOs are Cool": A survey of the trans-Neptunian region. XIII. Statistical analysis of multiple trans-Neptunian objects observed with Herschel Space Observatory, by Kovalenko et al. 2017, A&A 608, A19**
  - ***Thermal observations with Herschel/PACS***
  - ***Absolute magnitudes in V-band***
- **The thermal emission of Centaurs and trans-Neptunian objects at millimeter wavelengths from ALMA observations, by Lellouch et al. 2017, A&A 608, A45**
  - ***Thermal observations with ALMA and Herschel/PACS***
  - ***Absolute magnitudes in V-band***
- **Thermal infrared and optical photometry of Asteroidal Comet C/2002 CE10, Sekiguchi et al. 2018, Icarus 304, 95-100**
  - ***Optical observations with the 1.05m telescope at Kiso Observatory (Japan)***
  - ***Thermal observations with the 3.6m telescope at La Silla (ESO, Chile)***
  - ***Absolute magnitude in V-band***
- **Herschel-PACS photometry of faint stars for sensitivity performance assessment and establishment of faint FIR prime photometric standards, by Klaas et al. 2018, accepted by A&A in Nov. 2017**
  - ***Thermal observations with Herschel/PACS***

- **The AKARI IRC Asteroid Flux Catalogue: updated diameters and albedos, by Alí-Lagoa et al. 2018, accepted by A&A in Dec. 2017**
    - ***Thermal observations with AKARI***
    - ***Absolute magnitudes***
- **Thermophysical modeling of main-belt asteroids from WISE thermal data, by Hanuš et al. 2018, Icarus 309, 297-337**
    - ***Thermal observations with WISE***
    - ***Absolute magnitudes***
- **"TNOs are Cool": A survey of the trans-Neptunian region. XIII. Size/albedo characterization of the Haumea family observed with Herschel and Spitzer, by Vilenius et al., submitted to A&A in Jan. 2018**
    - ***Thermal observations with Herschel/PACS and Spitzer***
    - ***Absolute magnitudes in V-band***
- **In-flight performance of Thermal Infrared Imager on Hayabusa2 and its implications to observations of C-type asteroid 162173 Ryugu, by Okada et al., submitted to Planetary and Space Science in Feb. 2018**
    - ***Detailed study of the thermal infrared imager TIR onboard Hayabusa2 that will obtain thermal data of asteroid 162173 Ryugu***

- Several other publications related to this technique are in preparation.

6 Outlook

In this deliverable we have updated the list with all the publications or documents related to the SBNAF ground-based observations obtained with some of the complementary observational techniques we are using (i.e. time series observations, astrometric measurements, stellar occultations, absolute photometry and thermal measurements) at date 7 April 2018. This list will be updated in deliverable D5.8 –'Observational publications 3'. It is important to note that our IR database, which is being filled internally, will be made public soon, and eventually will be included in the VESPA[5] system. Last but not least, at the end of our project we plan to publish some of the SBNAF related ground-based measurements (e.g. MBAs lightcurves obtained to derive shape models) in dedicated data papers. Other ground-based data (e.g. shape models, astrometry measurements, MBAs lightcurves, H-magnitudes) will be publicly available via data bases like ISAM[6], DAMIT[7], PDS[8], MPC or CDS.

[5] VESPA system: http://www.europlanet-vespa.eu/
[6] ISAM: Interactive Service for Asteroid Models http://isam.astro.amu.edu.pl/
[7] DAMIT: Database of Asteroid Models from Inversion Techniques http://astro.troja.mff.cuni.cz/projects/asteroids3D/web.php
[8] PDS: The Planetary Data System https://pds.nasa.gov/

References

(A more extensive bibliography related with each observational technique can be found in deliverable D5.6)

- Johnson, H. L., & Morgan, W. W. 1953, ApJ, 117, 313
- Müller et al. 2017, Advances in Space Research, accepted in Oct. 2017