



# Optical Periscopic Imager for Comets (OPIC) Instrument for the Planned Comet Interceptor Mission

I. Ivanov<sup>1</sup>, M. Fujisaki<sup>2</sup>, J. Kvasil<sup>3</sup>, H. Terai<sup>4</sup>, A. Nikolaj<sup>5</sup>, A. S. Paul<sup>6</sup>, M. A. Shal<sup>7</sup>, A. Szymko<sup>8</sup>

<sup>1</sup>Taru Observatory, University of Taru, Observatorium 1, Tšavare, 61602 Estonia, [iivanov@taru.observatory.ee](mailto:iivanov@taru.observatory.ee)

This presents an update on the development of the Optical Periscopic Imager for Comets (OPIC) instrument [1], which will be hosted on one of three spacecraft making up the Comet Interceptor ESA-JAXA mission [2]. OPIC is a compact (40.5 kg) monochromatic camera for taking images of the nucleus and coma of either a long period or dynamically new comet, or an interstellar object for mapping, reconstruction and localisation purposes. The camera will operate in a harsh environment with continuous dust impacts throughout its multi-day operation; therefore, the instrument is equipped with a periscope, which protects optics from high-velocity impacts. The probe is spin-stabilised at 4–15 RPM and will be parked in Lagrange point L2 (launched with ARIEL telescope) and depart at a suitable time to intercept a target at velocity 10–70 km/s. The closest approach is approximately 400 km.

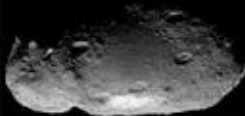
## OPIC



- 1 - Camera head (OICM)M-1 from 3D plus with CMV4000 2598-2598 pixel
- 2 - Optical assembly (Siwa LM65CM-V)
- 2a - Optical supports
- 3 - Periscope assembly
- 3a - Mirror
- 4 - Data and power interfaces
- 5 - E-mount adapter
- 6 - Interface plane with the probe
- 7 - Enclosure

## SISPO

Space Imaging Simulator for Proximity Operations (SISPO) is a newly developed physically-based space imaging simulator developed by us [3]. It is based on open-source Blender software and its Cycles rendering engine. SISPO is applicable for terminal-body mission-oriented operations, such as the design of advanced deep-space missions, the simulation of large sets of configurable scenarios, and the development and validation of algorithms for both autonomous operations, vision-based navigation, localisation and image processing.



Procedural texture generation with SISPO on example of Tokawa



Example of OPIC the spinning probe (near)

[1] Fujisaki, M., J. Kvasil, I. Ivanov, I. Anik, Szymko (2020), "Developing autonomous image capturing systems for maximum science yield for high fly-by velocity small solar system body exploration" <https://arxiv.org/abs/2009.09000v1>

[2] Woodgreen, Colin and Giovanni (2019), "The European Space Agency's Comet Interceptor 'see it real'" Infuture communications 15, no. 1-4 <https://doi.org/10.1002/inf.1218>

[3] Fujisaki, M., Ivanov, I., G. J. Szymko, J. Kvasil, M. Shal, O. Nikolaj, M. A. Paul, and K. Szymko (2021), "SISPO: Space Imaging Simulator for Proximity Operations" <https://arxiv.org/abs/2104.04772>

1  
00:00:04,150 --> 00:00:02,470  
hello everybody my name is jaroslav

2  
00:00:06,470 --> 00:00:04,160  
kobiewski i'm a phd student in

3  
00:00:08,549 --> 00:00:06,480  
university of tartu in estonia and we

4  
00:00:10,390 --> 00:00:08,559  
are developing an optical instrument for

5  
00:00:12,310 --> 00:00:10,400  
the comet interceptor mission is an

6  
00:00:14,789 --> 00:00:12,320  
upcoming mission of european space

7  
00:00:17,750 --> 00:00:14,799  
agency and japanese space agency which

8  
00:00:19,510 --> 00:00:17,760  
to be launched in 2029 uh will study

9  
00:00:20,950 --> 00:00:19,520  
either a long period comet or a

10  
00:00:22,630 --> 00:00:20,960  
dynamically new comet or any

11  
00:00:24,790 --> 00:00:22,640  
interstellar object

12  
00:00:27,109 --> 00:00:24,800  
so the target is not known as of yet

13  
00:00:28,870 --> 00:00:27,119

there's a list of potential targets but

14

00:00:31,589 --> 00:00:28,880

we will park in lagrange 0.2 and be

15

00:00:32,630 --> 00:00:31,599

waiting for the for our object to come

16

00:00:34,549 --> 00:00:32,640

and

17

00:00:36,950 --> 00:00:34,559

the instrument is is a lightweight small

18

00:00:39,110 --> 00:00:36,960

visible camera which will be hosted on

19

00:00:40,869 --> 00:00:39,120

one of three spacecrafts and

20

00:00:43,350 --> 00:00:40,879

in order to develop it and simulate the

21

00:00:44,869 --> 00:00:43,360

images which we gonna obtain we also

22

00:00:47,190 --> 00:00:44,879

developed the simulator for the image

23

00:00:49,270 --> 00:00:47,200

generation which you have seen right

24

00:00:50,869 --> 00:00:49,280

an example of of generated irakawa

25

00:00:52,790 --> 00:00:50,879

surface images so

26

00:00:54,709 --> 00:00:52,800

we use open source blender

27

00:00:56,470 --> 00:00:54,719

and procedural texture generation to

28

00:00:58,229 --> 00:00:56,480

create such images and