# Hera Flyby Target

## - Selection of candidates

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*Hera workshop, Berlin, 2018 November 15-16*

# Hera flyby opportunities

- Hera passes close to asteroids in each mission scenario

- Number with $H_V < 20$ (200 m < *D* < 600 m):

| Mission | <0.05 AU | <0.01 AU |
|---|---|---|
| ema2024 | 570 | 21 |
| ea2024 | 621 | 30 |
| ea2025 | 70 | 2 |
| eea2025 | 574 | 24 |

Need to establish criteria for selection of best candidates for Hera flyby based primarily on scientific interest

# Hera flyby target selection criteria

## 1: Binary asteroid

- Allows comparison of binaries.
- Identification of common and different characterictics.
- Potential insight into formation and evolution of binaries.

## 2: Non-S type asteroid

- Greater taxonomic diversity.
  (S-types most abundant among spacecraft encounters to date).

## 3: Fresh surface

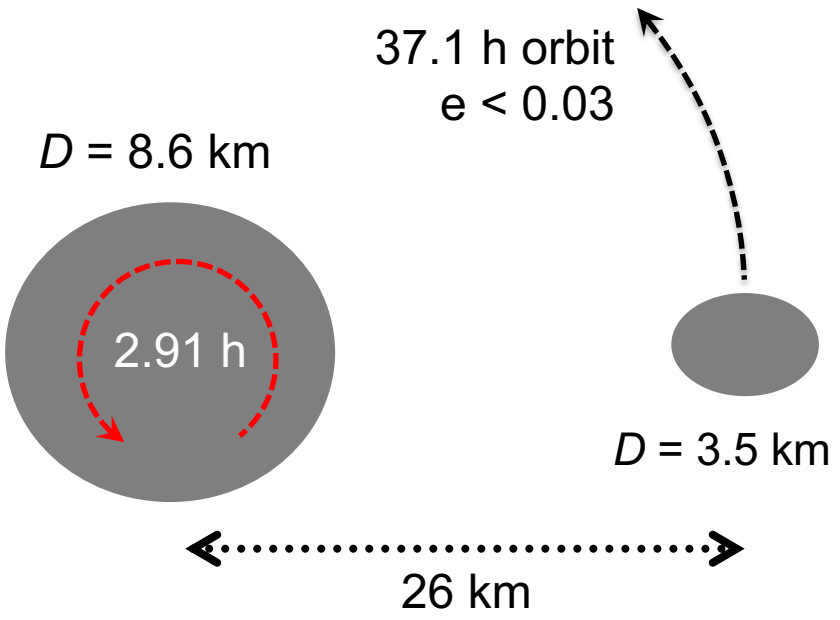
- Insight into space weathering.
- Q = unweathered S type. Relation unknown for other classes.
- Active, paired or clustered asteroids may have exposed unweathered surfaces.

Need candidates with known properties, or have opportunity to make observations to determine them before Hera flies.

# Binary and Binary/pair

## 2121 Sevastopol

(ema2024, nominal distance 0.0361 AU)




$p_V$ = 0.21 (consistent with S type)

Bulk density 1.4 – 2.7 g cm$^{-3}$

$a_P/b_P$ = 1.15, $a_S/b_S$ = 1.42


Pravec et al., Binary asteroi population. 3. Secondary rotations and elongations. Icarus 267, 267-295, 2016

Pravec et al., Asteroid pairs, a complex picture. *in prep.*

Scheirich et al., Astmmetric distribution of orbital poles of binary asteroids. *In prep.*

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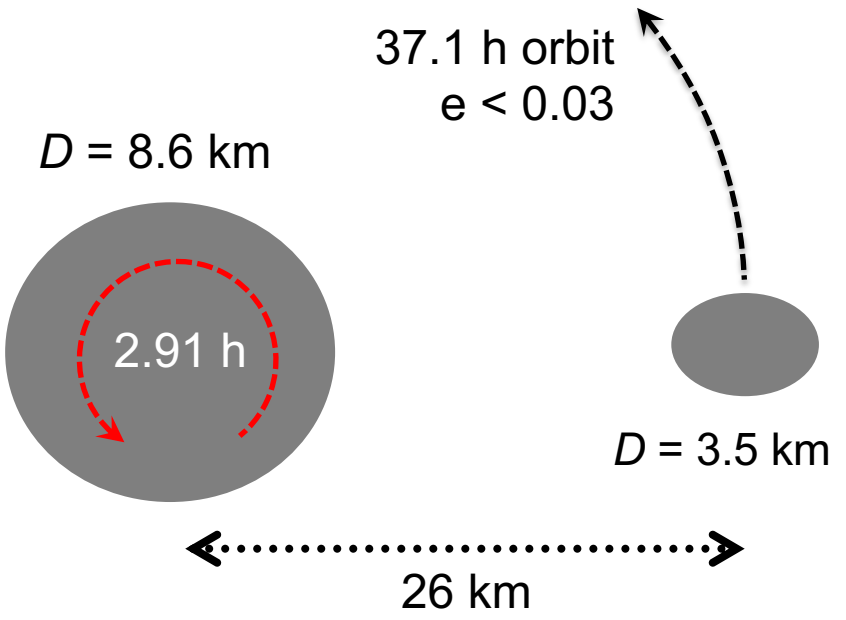


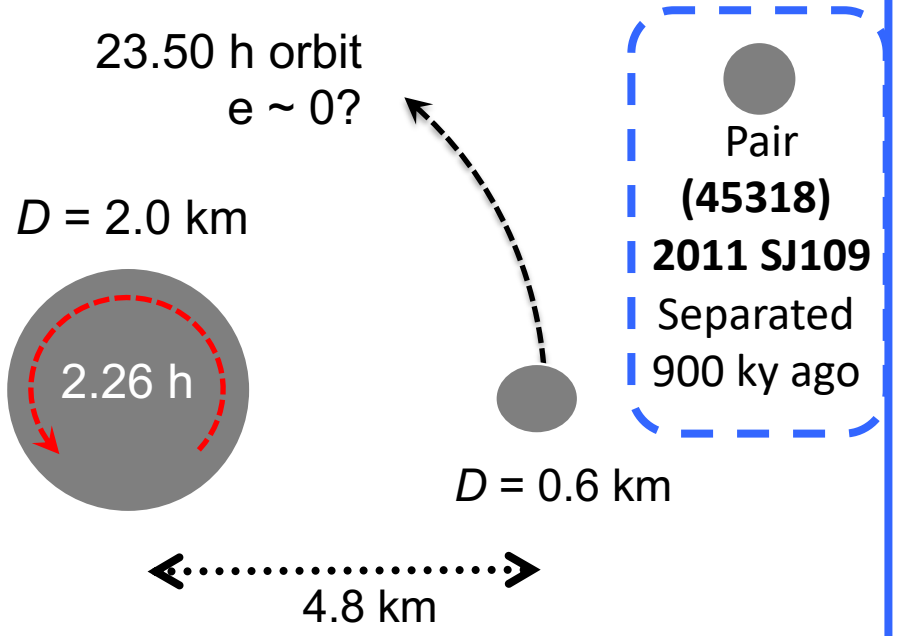

$p_V$ = 0.21 (consistent with S type)

Bulk density 1.4 – 2.7 g cm$^{-3}$

$a_P/b_P$ = 1.15, $a_S/b_S$ = 1.42

## 25021 Nischaykumar

(ea2024, nominal distance 0.0051 AU)




$p_V$ = 0.16, $V$–$R$ = 0.51 (consistent with S type)

Bulk density > 1.1 g cm$^{-3}$

$a_P/b_P$ = 1.05, $a_S/b_S$ = 1.46

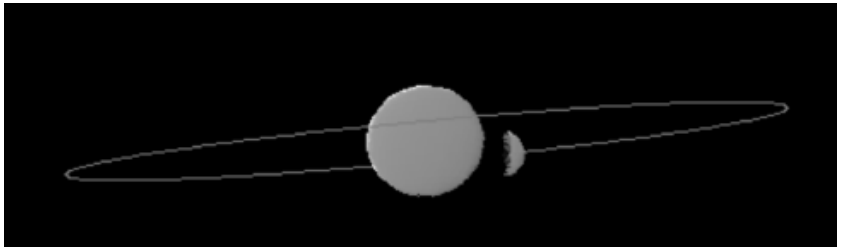

Pravec et al., Binary asteroi population. 3. Secondary rotations and elongations. Icarus 267, 267-295, 2016

Pravec et al., Asteroid pairs, a complex picture. *in prep.*

Scheirich et al., Astmmetric distribution of orbital poles of binary asteroids. *In prep.*

# Observing opportunities

- Sevastopol, Nischaykumar and Didymos observable in 2019
- VLT/NTT proposal submitted for rotationally resolved spectra
- Search for mobility of surface materials



**2121 Sevastopol**

- April 2019 V ~ 15
- Mutual eclipses/occultations
- $D_s/D_p$ = 0.41 allows rotationally resolved spectra of primary *and* secondary

**25021 Nischaykumar**

- April 2019 V ~ 20
- Rotationally resolved spectra of primary

# Search for ideal Hera flyby target

- ~15% of small (*D* <~10 km) asteroids are binary
- Binary detection efficiency of photometric technique ~ 30-40% (Pravec et al. 2006, 2012),

  → one binary asteroid detection per ~20 surveyed asteroids.

- Survey among Hera flyby candidates
  for targets satisfying both criteria 1 and 2:

  a: Spectral survey for non-S type asteroids

  b: Photometric survey for binaries among identified non-S types.