



Technische
Universität
Braunschweig

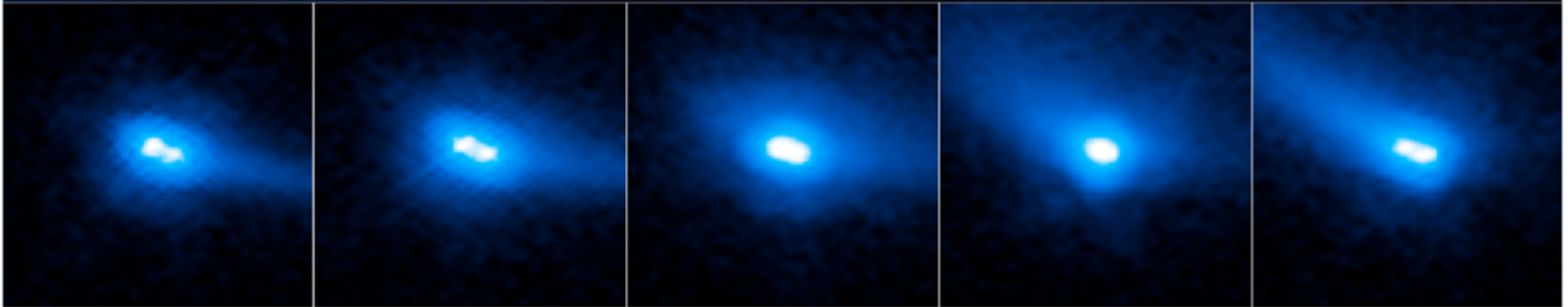


Bild: NASA, ESA, und J. Agarwal (MPS)

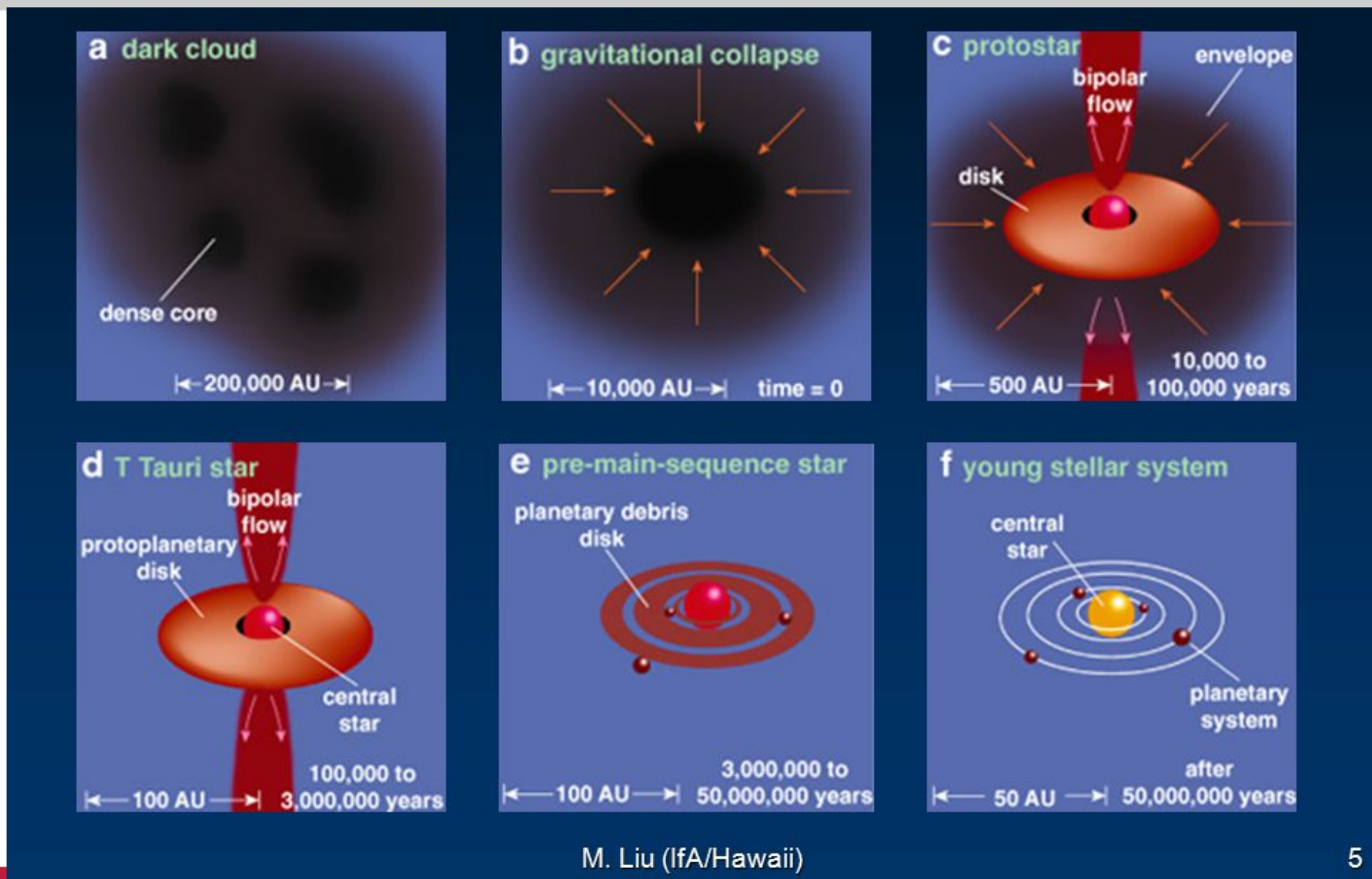
Aktive Asteroiden

Zum Schülerinformationstag Physik 2021

Jessica Agarwal, 6. Februar 2021

Kleinkörper im Sonnensystem

Unser Sonnensystem ist aus einer Wolke aus Staub und Gas entstanden.



M. Liu (IfA/Hawaii)

Die Kleinkörper des Sonnensystems befinden sich heute in drei Reservoiren.

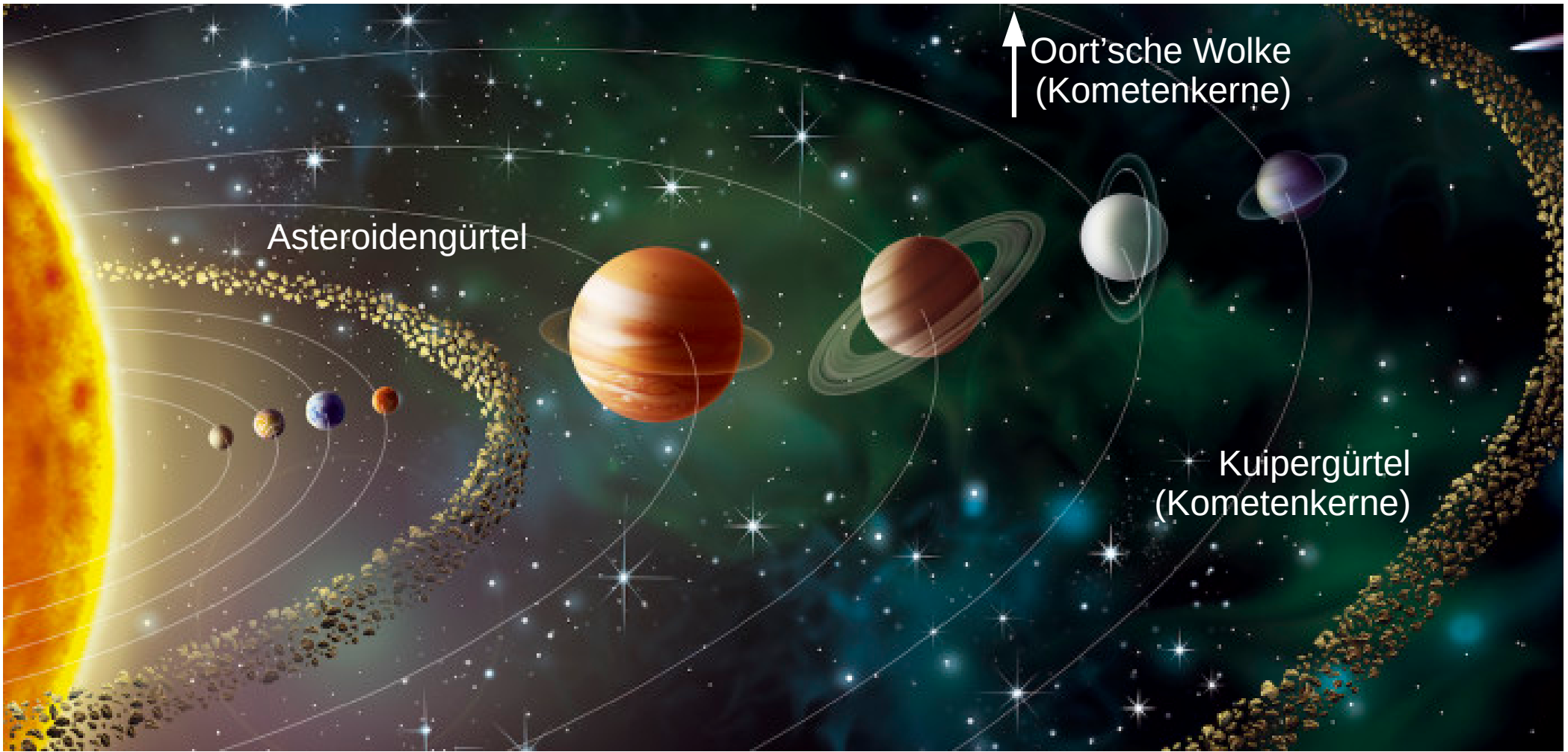


Bild: BSIG/UIG/Getty Images

Kometen entwickeln in Sonnennähe Aktivität, während Asteroiden meist steinig bleiben.

Komet 67P/Churyumov-Gerasimenko

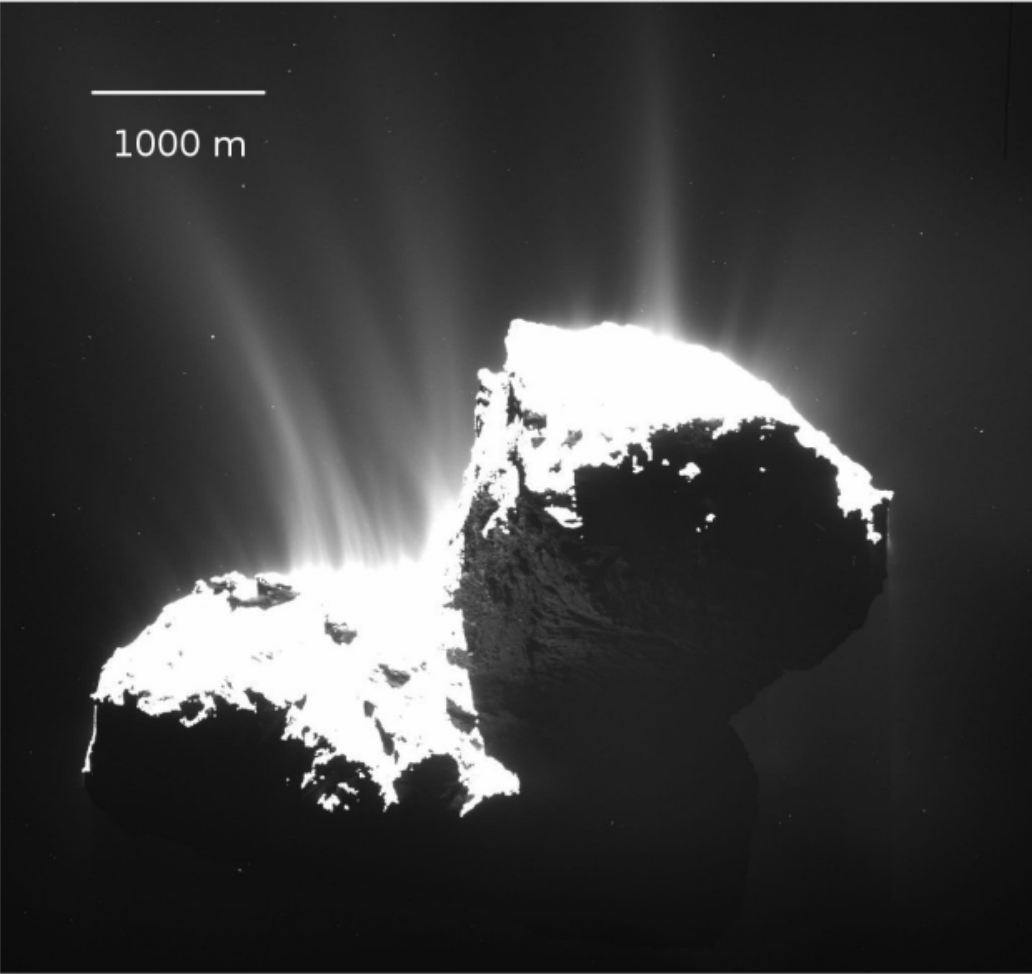


Bild: ESA/Rosetta/MPS for OSIRIS Team
MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA

Asteroid (25143) Itokawa

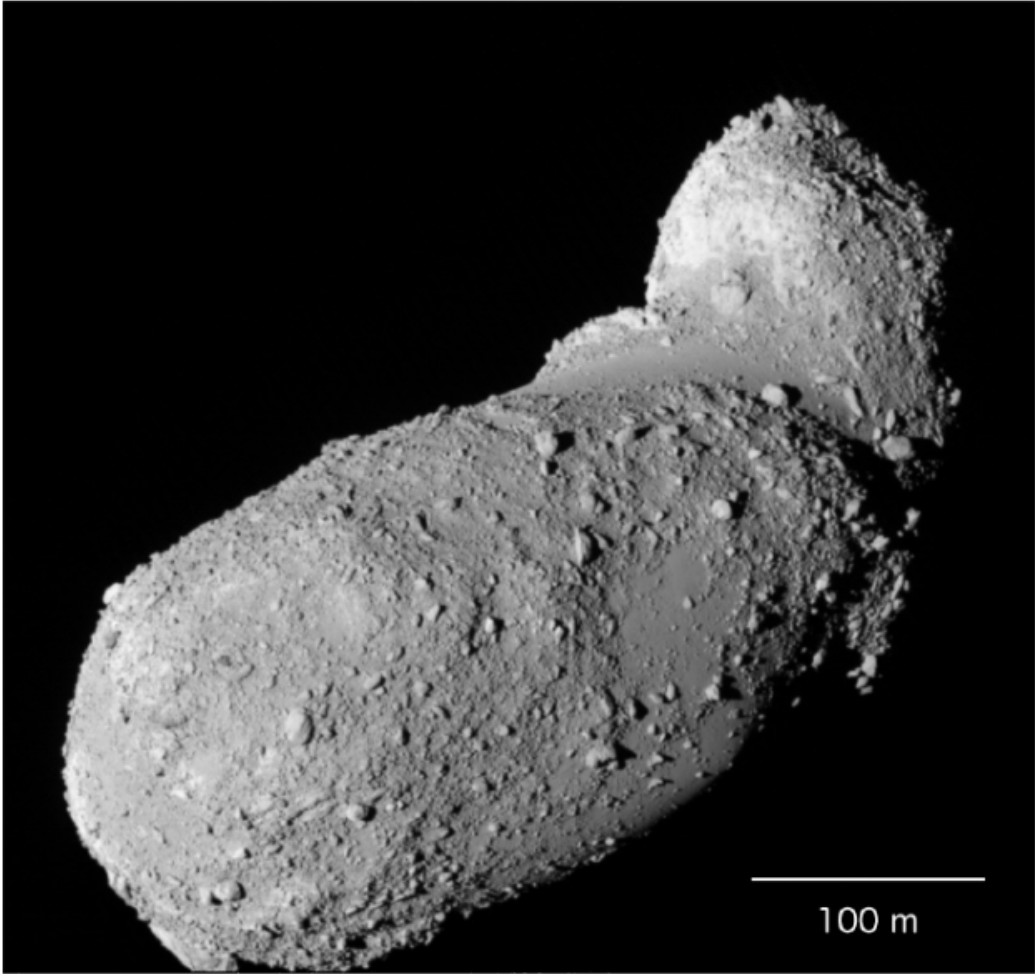


Bild: ISAS/JAXA

Im Teleskop zeigen Kometen oft einen (Staub-)Schweif, während Asteroiden punktförmig bleiben.

Komet 67P/Churyumov-Gerasimenko



Bild: Thüringer Landessternwarte, Weiler et al. (2004)

Asteroid (25143) Itokawa

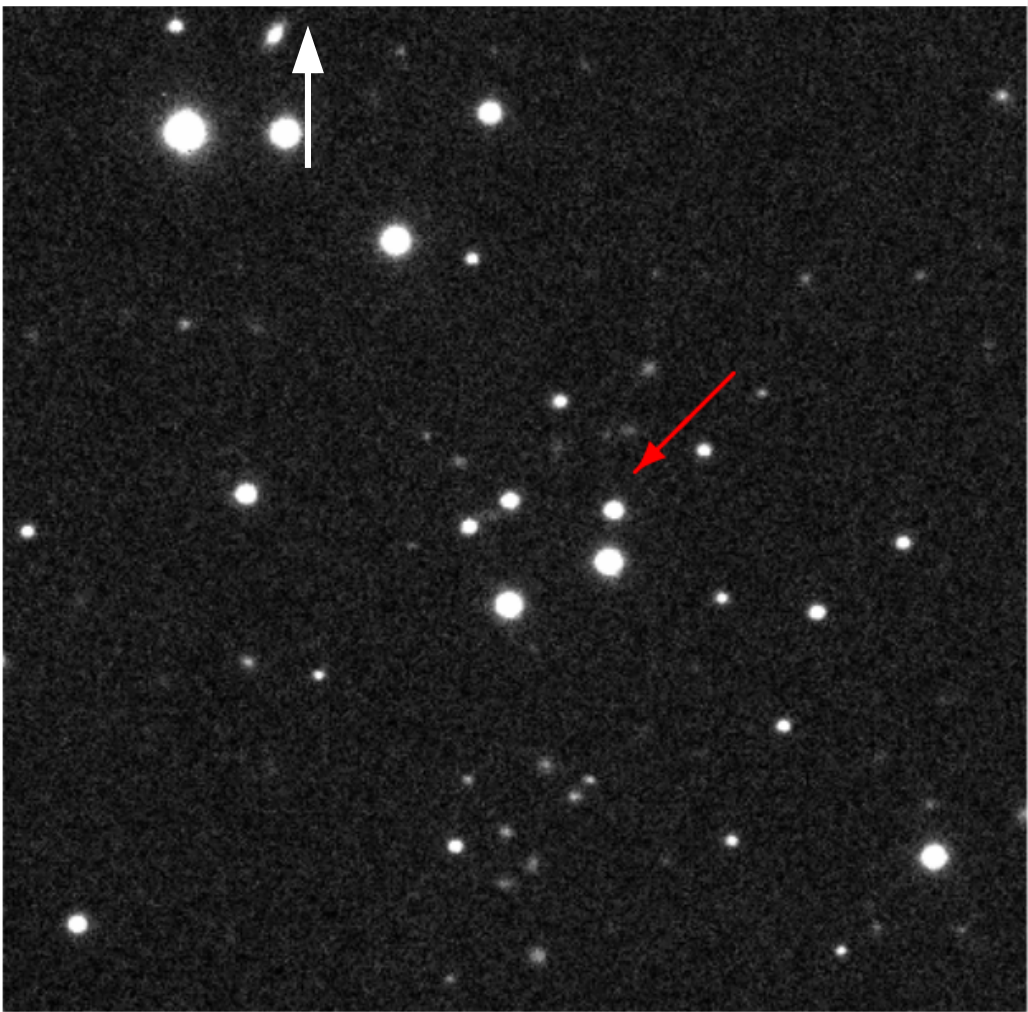
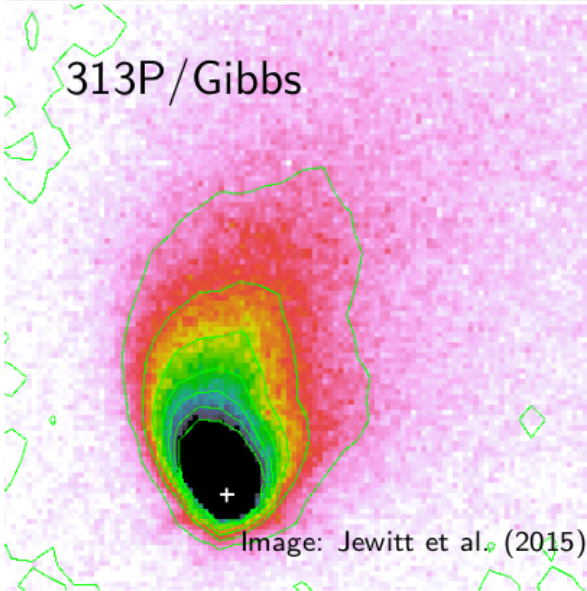
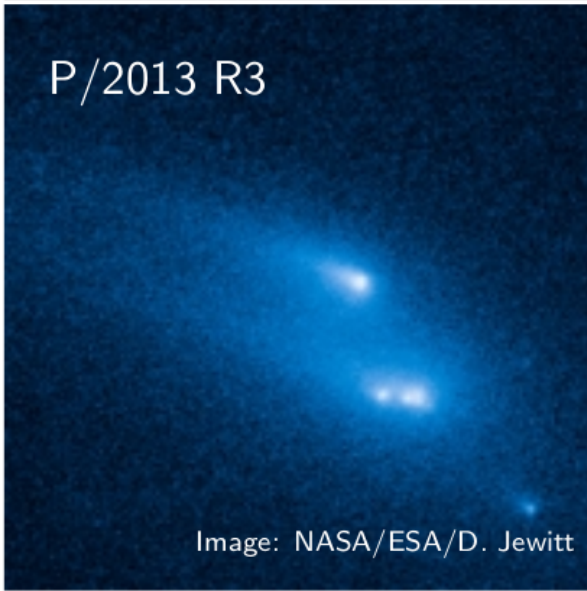
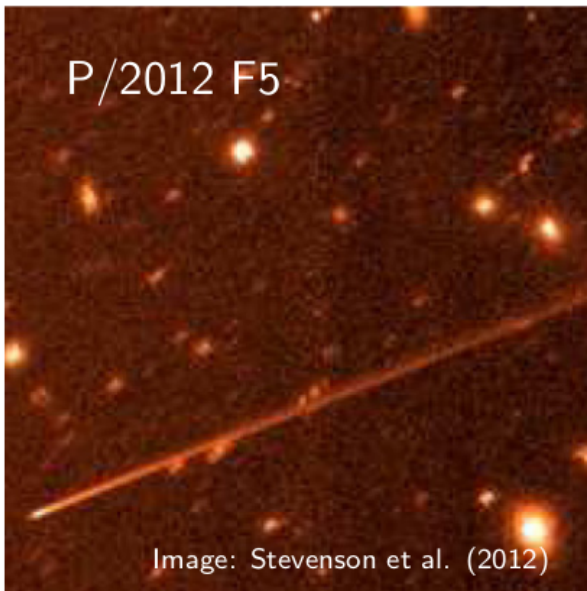
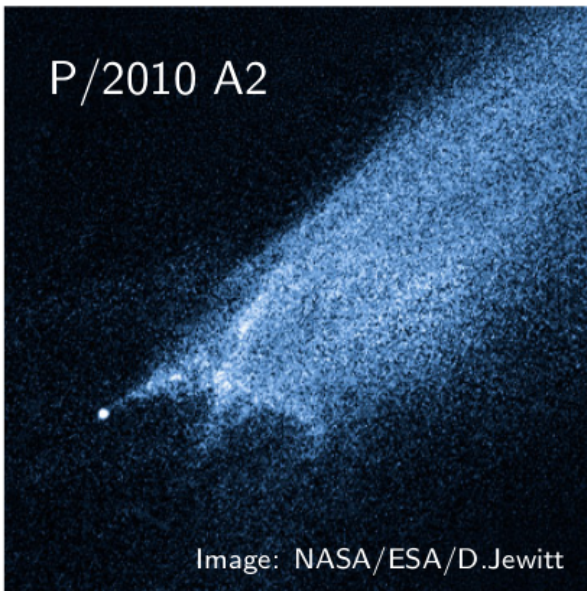
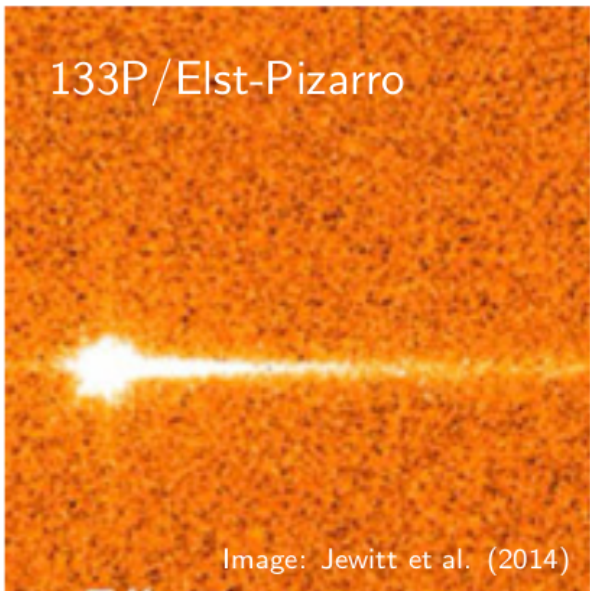


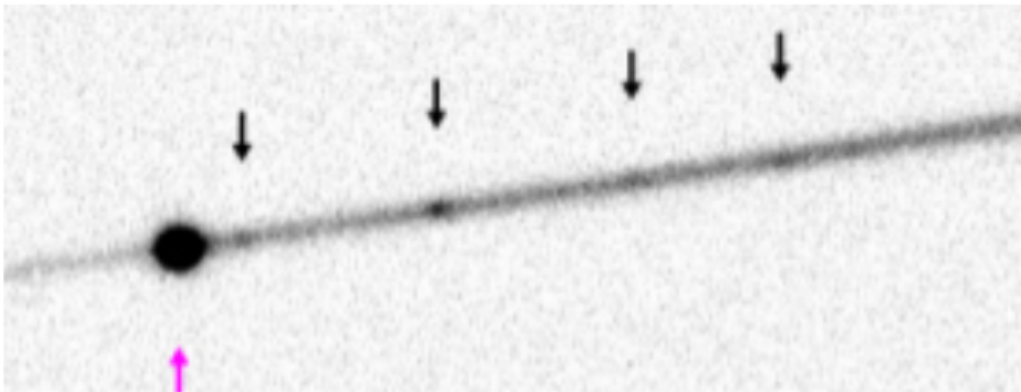
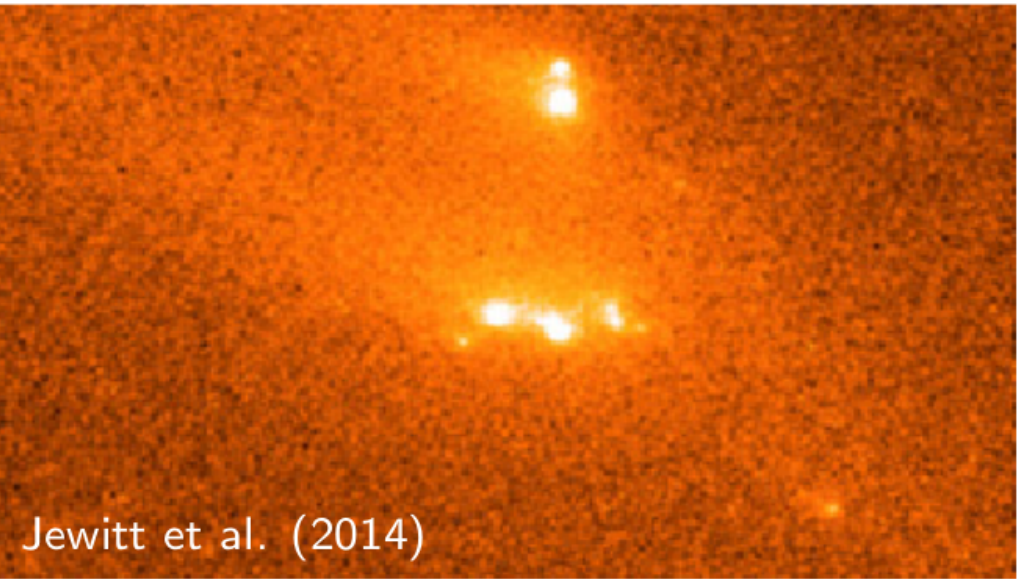
Bild: University of Hawaii, D. J. Tholen and F. Bernardi

Aktive Asteroiden

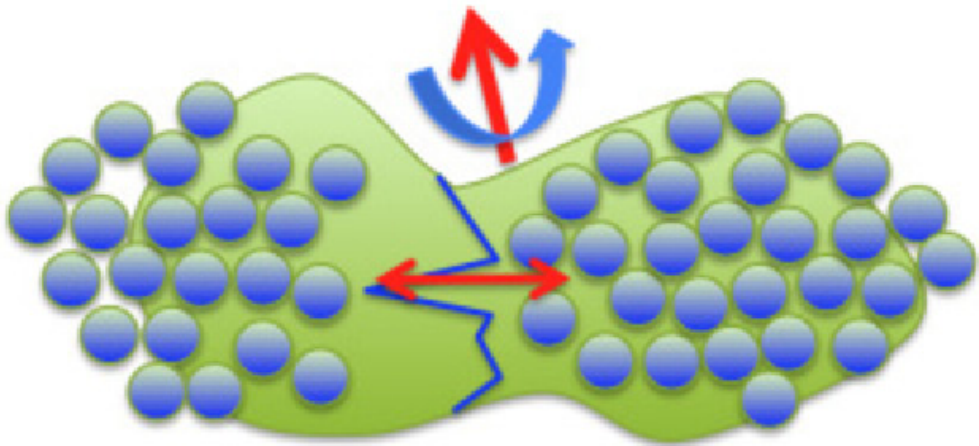
Aktive Asteroiden zeigen vorübergehend Staubschweife wie Kometen.



Auch schnelle Rotation kann Staubemission hervorrufen.



Structural failure



Surface shedding

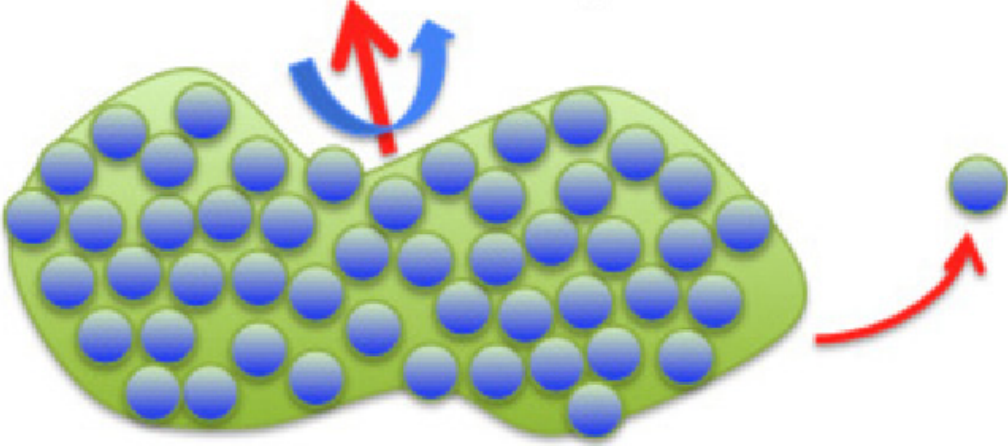


Bild: Hirabayashi et al. (2014)

Asteroidenaktivität kann durch Kollisionen hervorgerufen werden.

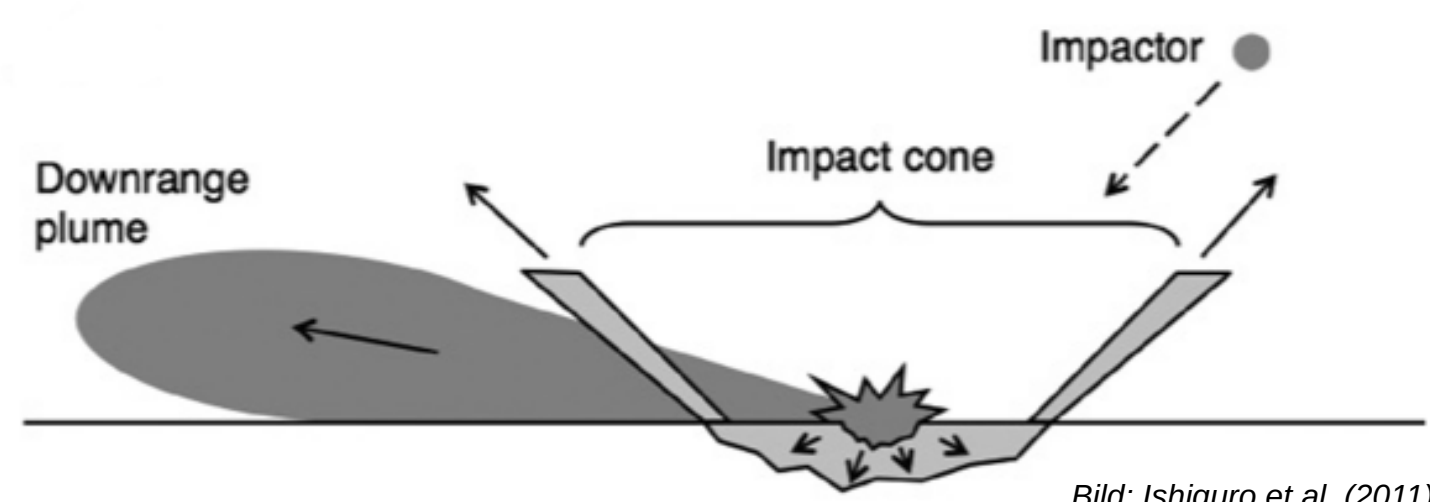
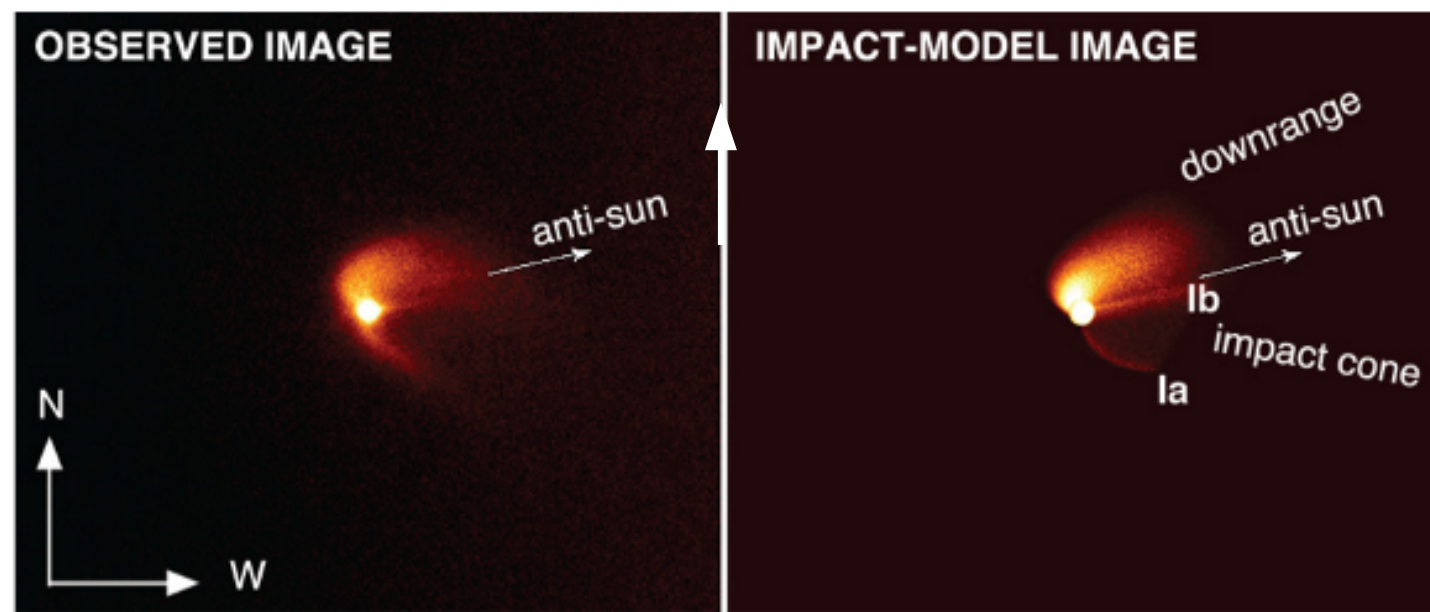
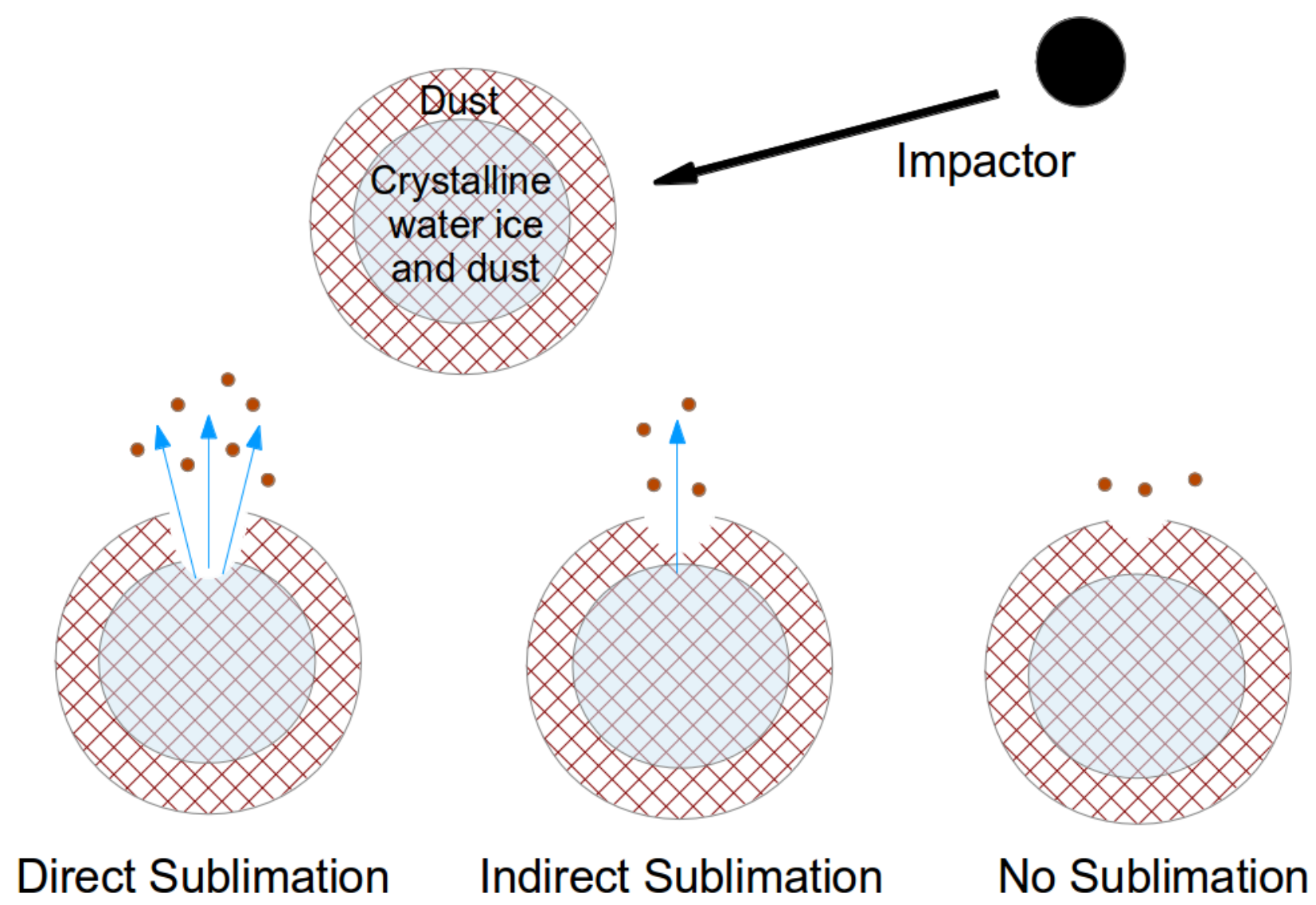


Bild: Ishiguro et al. (2011)

Wenn Eis aus dem Inneren freigesetzt wird, kommt es zu länger anhaltender Aktivität wie bei Kometen.



Beispiel: Der aktive Asteroid 288P

Die Aktivität des Asteroiden 288P wird wahrscheinlich durch die Sublimation von Eis verursacht.

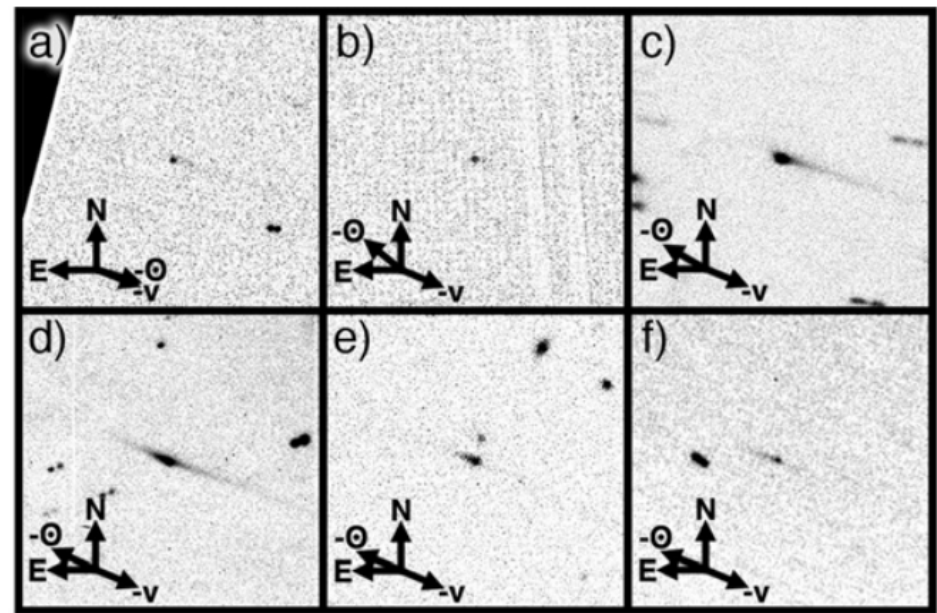


Bild: Hsieh et al. (2012)

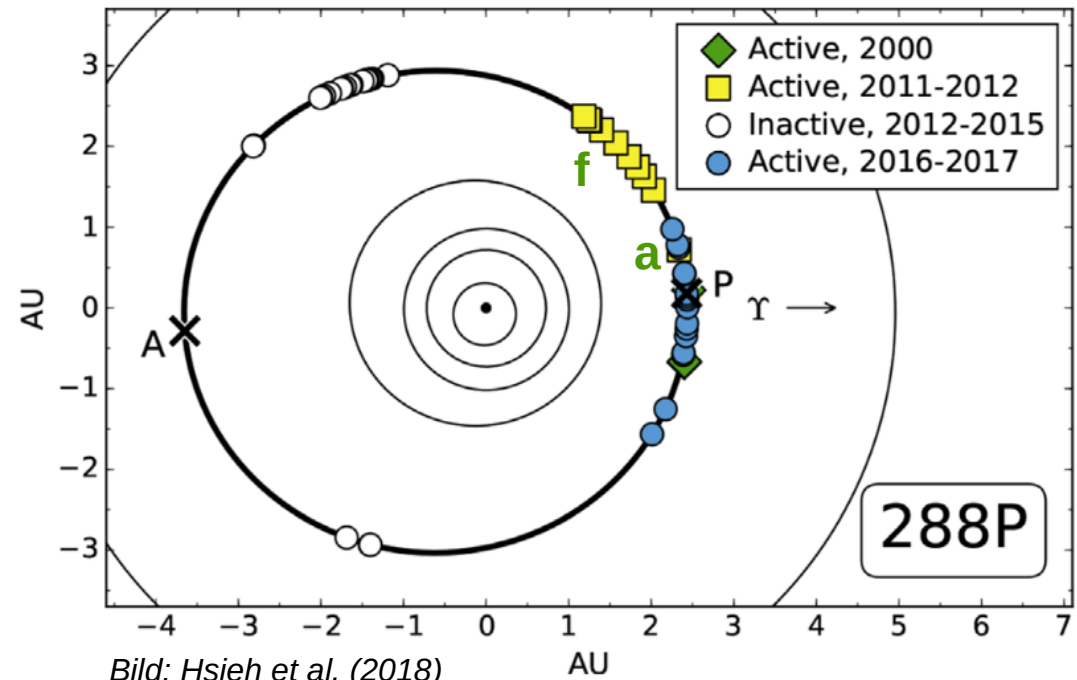
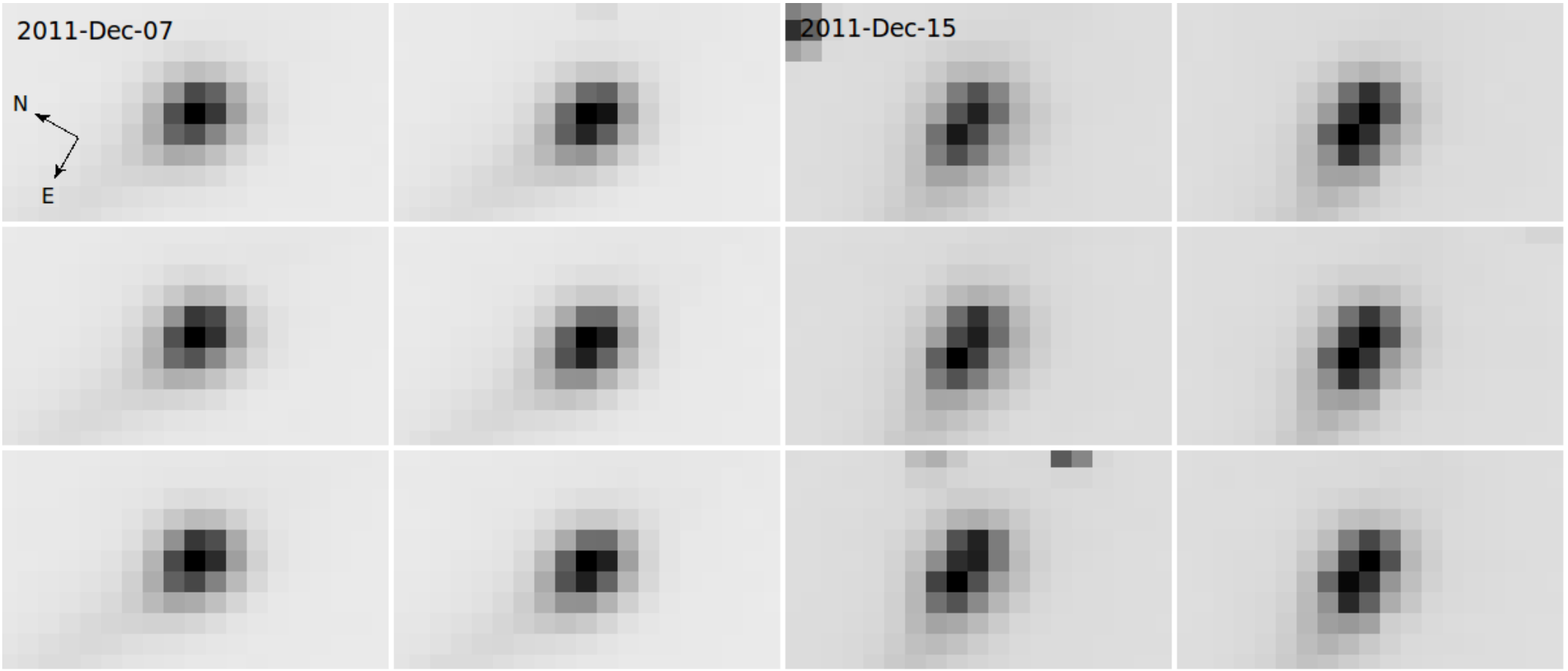


Bild: Hsieh et al. (2018)

288P zeigte in Hubble-Bildern von 2011 eine merkwürdige Formveränderung.



- Splitting? --> Keine zweite Komponente gefunden (2012)
- Staubemission? --> Helligkeitsentwicklung passt nicht (2014)
- Gravitativ gebundenes Doppelsystem? (2015) --> Neue Hubble-Beobachtungen beantragen (2016)

Um die Hypothese vom Doppelasteroiden zu prüfen, haben wir 2016 neue Hubble-Daten beantragt.

Hubble Space Telescope

Cycle 24 GO Proposal

<ID>

Investigating the binary nature of active asteroid 288P/300163

Scientific Category: Solar System
Scientific Keywords: Comets, Minor Planets
Instruments: WFC3
Proprietary Period: 12 months
Proposal Size: Small

Orbit Request	Prime	Parallel
Cycle 24	5	0

Abstract

We propose to study the suspected binary nature of active asteroid 288P/300163. We aim to confirm or disprove the existence of a binary nucleus, and -- if true -- to measure the mutual orbital period and orbit orientation of the components, and their sizes. We request 5 orbits of WFC3 imaging, spaced at intervals of 8-12 days. 288P belongs to the recently discovered group of active asteroids, and is particularly remarkable as HST images obtained during its last close approach to Earth in 2011 are consistent with a barely resolved binary system. If confirmed, 288P would be the first known active binary asteroid. For the first time, we would see two important consequences of rotational break-up in a single object: binary formation and dust ejection, highlighting the importance of the YORP-effect in re-shaping the asteroid belt. Confirming 288P as a binary would be a key step towards understanding the evolutionary processes underlying asteroid activity. In order to resolve the two components we need 288P at a geocentric distance comparable to or less than we had in 2011 December (1.85 AU). This condition will be fulfilled for the first time since 2011, between mid-July and mid-November of 2016. The next opportunity to carry out such observations will be in 2021.

Die neuen Bildern bestätigten, dass es sich um ein Doppelsystem handelt.

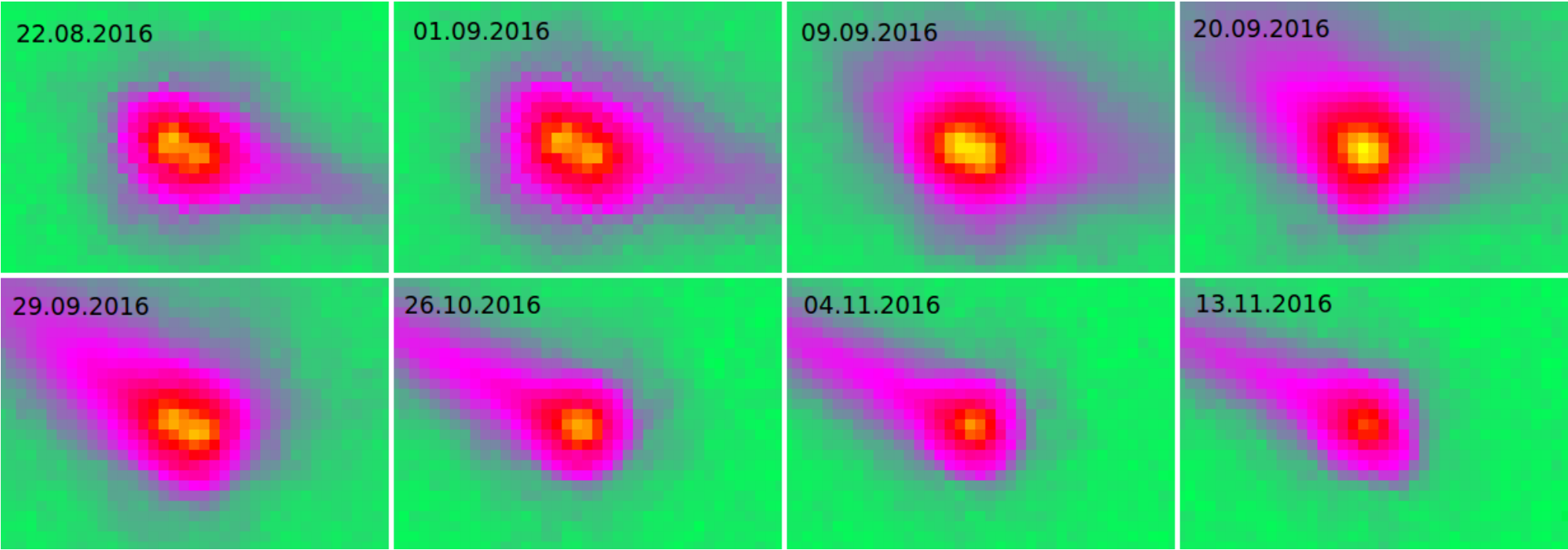


Bild: Agarwal et al. (2017)

Die Bahnparameter des Doppelsystems unterscheiden sich von denen aller bisher bekannten Systeme.

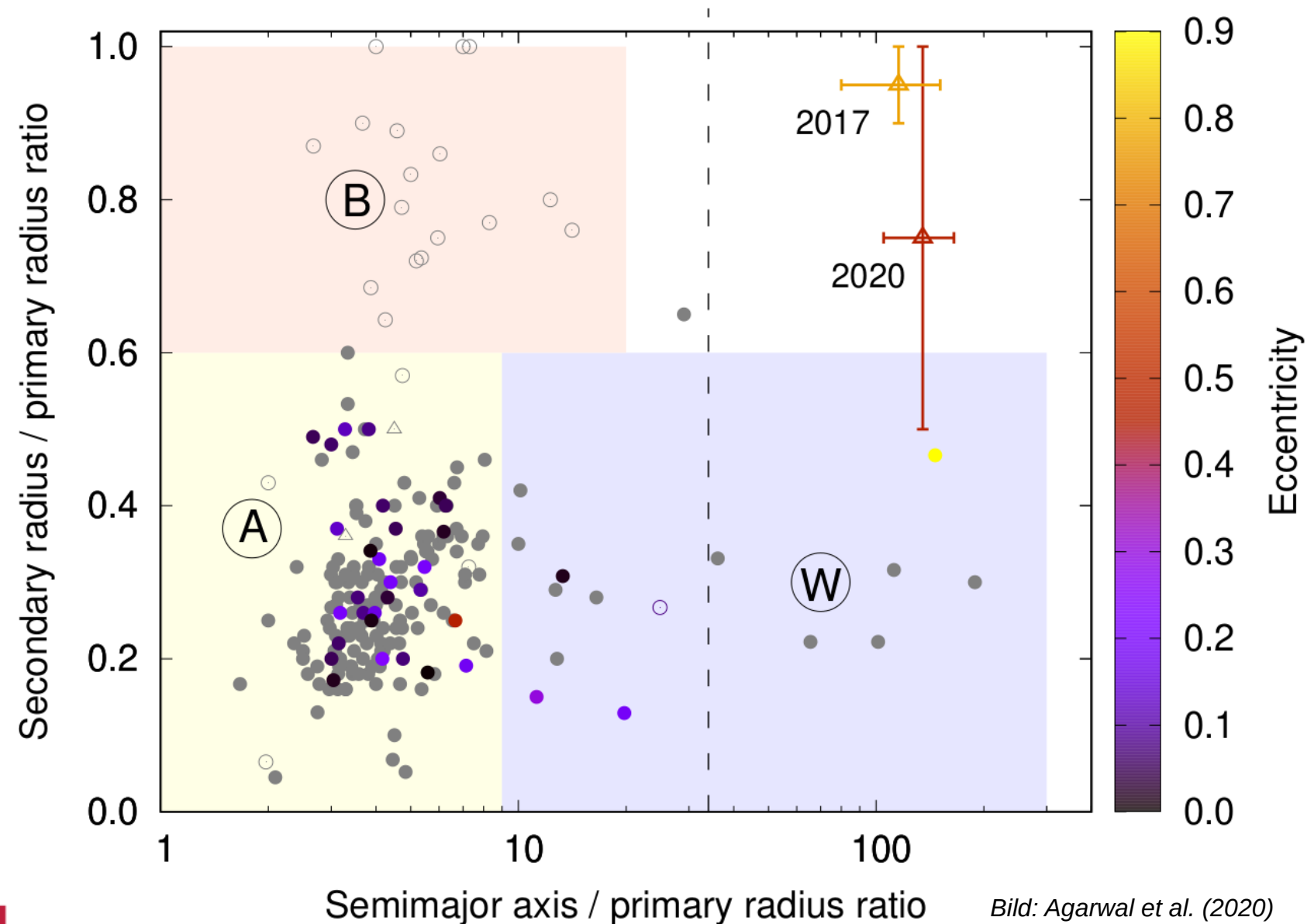
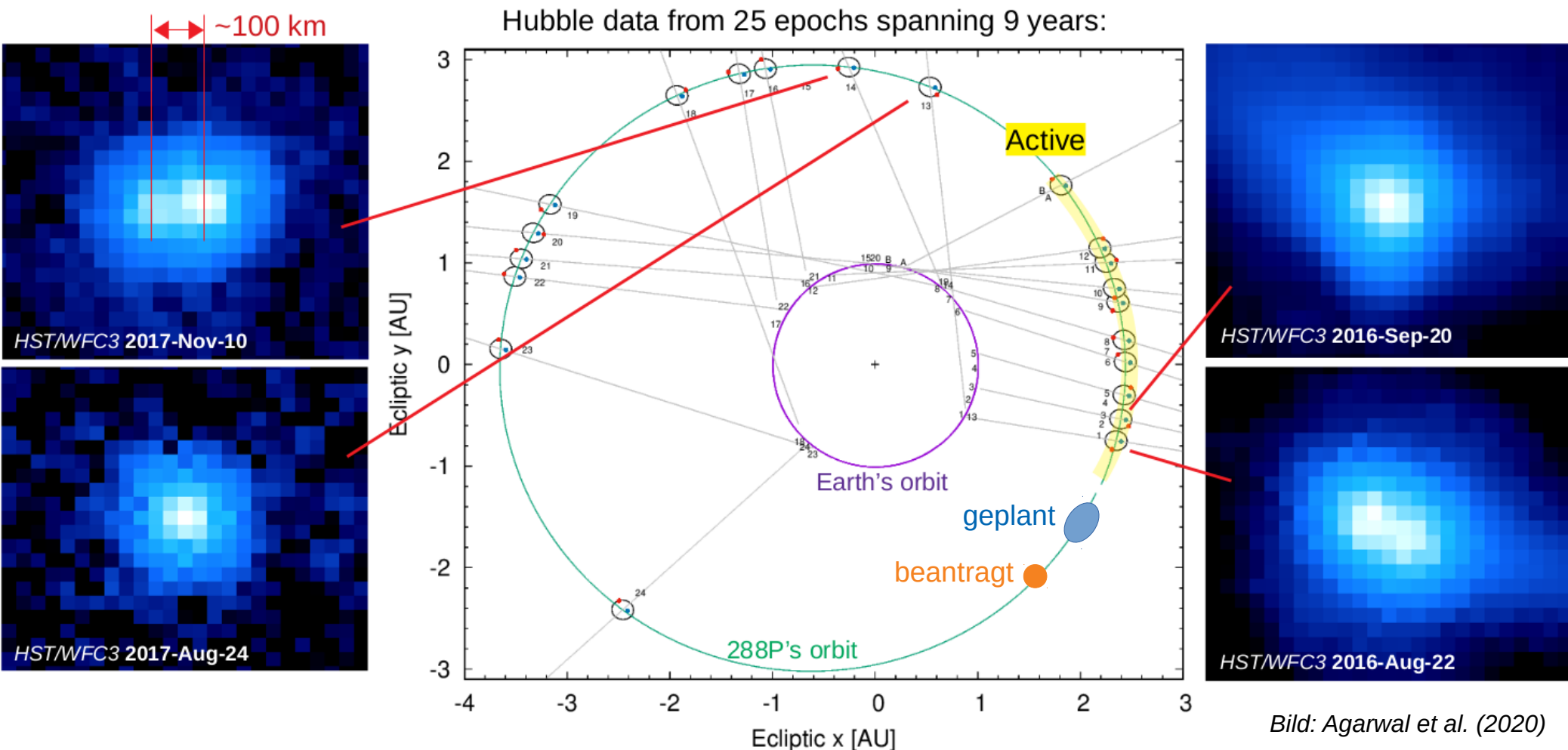


Bild: Agarwal et al. (2020)

Inzwischen haben wir Daten von fast einem ganzen Sonnenumlauf und immer neue Fragen.



Zusammenhang zwischen ungewöhnlichem Orbit und Aktivität?

Rotationszustände der Komponenten?