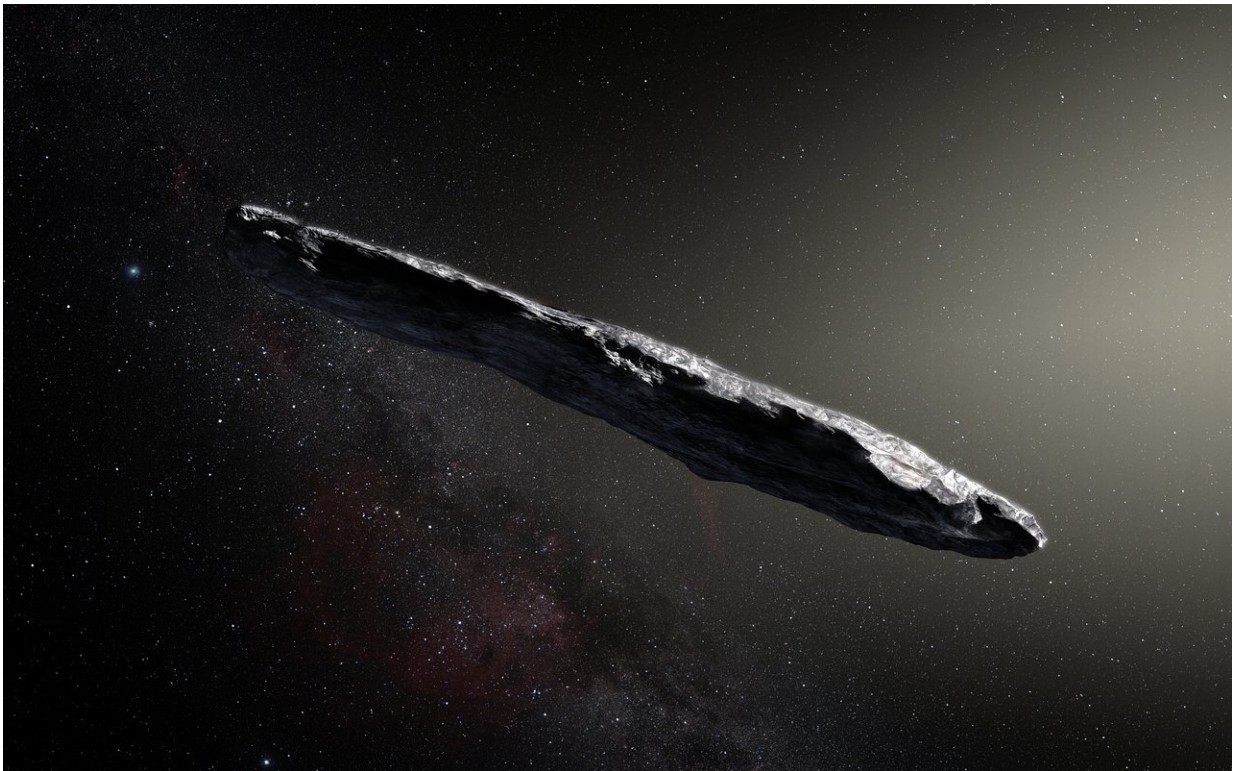


When stars get too close to each other, they cast out interstellar comets and asteroids

April 19 2021



Artist's impression of Oumumua. Credit: ESO/M. Kornmesser

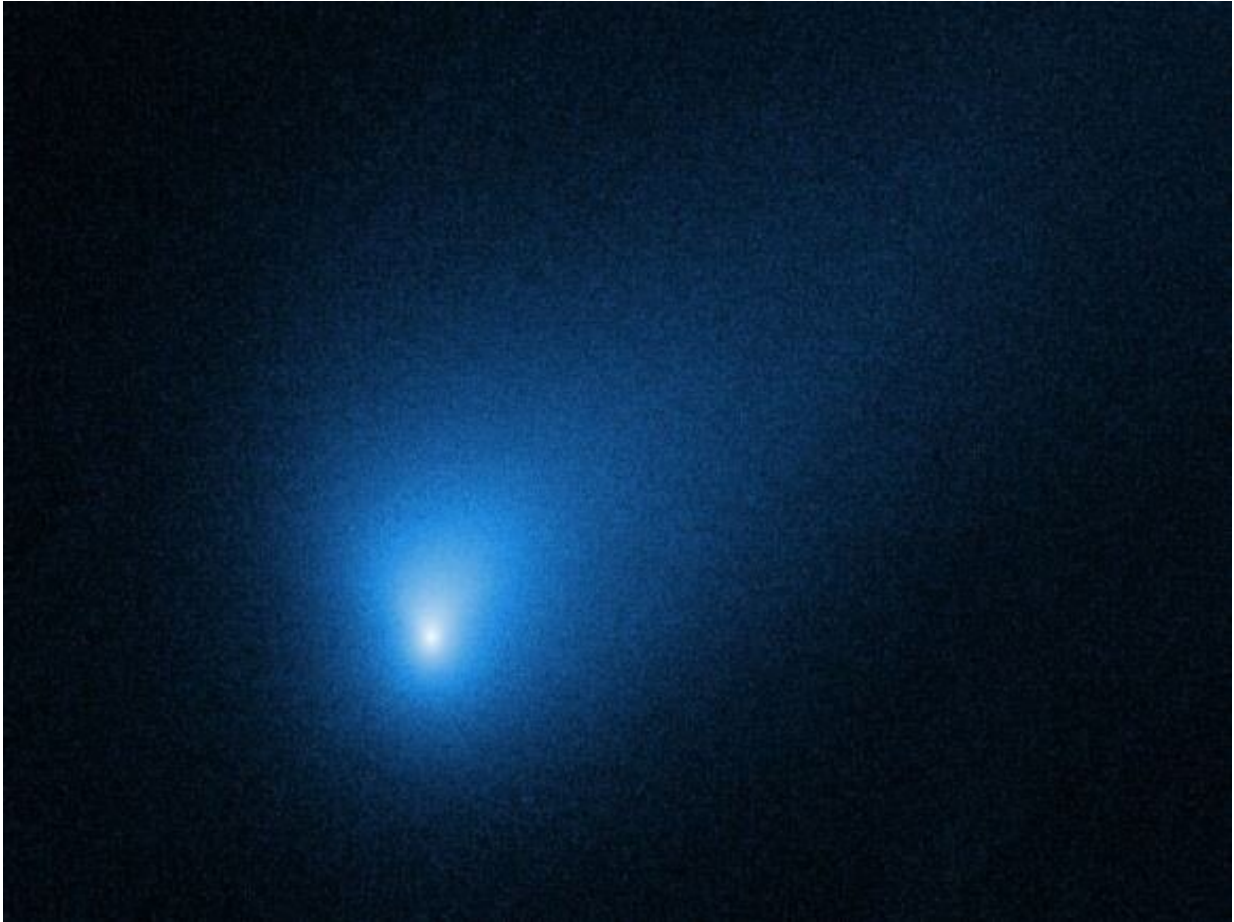
In October 2017, humanity caught its first-ever glimpse of an interstellar object—a visitor from beyond our solar system—passing nearby the sun. We named it "Oumuamua, and its unusual properties fascinated and confounded astronomers. Less than two years later, amateur astronomer

Gennady Borisov found a second interstellar object: a comet-like body that began to disintegrate as it passed within 2 AU of the sun (1 AU equals the distance from Earth to the sun). Where do these interstellar objects come from? How common are they? With a sample size of just two, it's difficult to make any generalizations just yet. On the other hand, given what we know about star formation, we can begin to make some inferences about the likely origins of these objects, and what we are likely to see of them in the future.

One of the most likely culprits for ejecting asteroids and comets into [interstellar space](#) is [close encounters](#) between stars. Four researchers studying this question—Susanne Pfalzner, Luis Aizpuru Vargas, Asmita Bhandare, and Dimitri Veras—released a paper last week examining this process.

When stars get too close to each other, they can cause [gravitational interactions](#) that wreak havoc on the stars' orbiting bodies. As the researchers explain, "such close flybys happen most frequently during the first 10 million years of a star's life." This is because stars tend to form close together in clusters, born collectively from enormous clouds of gas. During this turbulent early period of their life, stars can approach each other and rip tiny planetesimals out into deep space in the process, leaving them alone as wayward travelers in the night. Not all stars experience such violent interactions. It tends to be a small subset of stars that eject most of the interstellar objects.

When these interactions do occur, the mass of the stars involved matters a great deal. High-mass [stars](#) that come within 250AU of each other can rip away so much material that more than half of a system's planetesimals might be turned into interstellar objects, leaving little behind in orbit around the parent star.



The second interstellar object ever discovered passing through our solar system, 2I Borisov, in October 2019. Credit: NASA, ESA, and D. Jewitt (UCLA)

The researchers were also able to predict the expected velocities of ejected objects, and perhaps most interestingly, their composition. Asteroids tend to form closer to their star, with comet-like objects further out. The comets are therefore more susceptible to ejection, meaning that most interstellar objects likely look more like Borisov and less like "Oumuamua, which had asteroid-like properties.

There are other processes that can eject planetesimals, too. Interactions with [giant planets](#) like Jupiter, for example, can throw asteroids out into

deep space. We might be able to tell which method ejected an individual [object](#) by its speed—planetary scattering tends to create faster-moving objects, while stellar interactions produce slower-moving ones.

"Oumuamua was very slow, making stellar interaction a likely source. Planetary scattering, on the other hand, can't be ruled out for the faster-moving Borisov.

The paper also produced a fascinating result concerning our own solar system: it probably ejected about 2-3 Earth masses worth of material out into deep space during the formation of our star. That means that while we sit waiting for the next "Oumuamua or Borisov to visit us, our own interstellar comets and asteroids are out there now, visiting alien worlds and distant suns.

More information: Significant interstellar object production by close stellar flybys. arxiv.org/pdf/2104.06845.pdf

Provided by Universe Today

Citation: When stars get too close to each other, they cast out interstellar comets and asteroids (2021, April 19) retrieved 25 April 2024 from <https://phys.org/news/2021-04-stars-interstellar-comets-asteroids.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.