Across the Cosmos December 2025:
Spiders on Europa

OK, the title of this column should have been "Spider-like Features on Europa", but I shamefully wanted to grab your attention! One of my colleagues at the Planetary Science Institute, Elodie Lesage[1], is a co-author on a new study of a curiously familiar surface feature on Europa that was recently published in the Planetary Science Journal.[2] So-called "lake stars" on Earth are branching, radial patterns that form when snow falls on frozen lakes and the weight of the snow creates holes in the ice, allowing water to flow through the snow.[3] In a similar manner, the spider-like feature identified on Europa might have formed through the eruption of melted brines following an impact that produced the crater in which it resides.

Of course, conditions on Europa are very different from those on Earth! Europa is extremely cold, and its atmosphere is extremely low pressure.[4] To test the formation hypothesis, the team conducted both field and laboratory experiments, by observing lake stars in Breckenridge, Colorado, and recreating the process in a cryogenic glovebox at JPL, using Europa ice simulants cooled with liquid nitrogen. They ran the lab experiments under different temperatures and found that similar star-like patterns formed even under extremely cold temperatures (-100°C), supporting the idea that a subsurface brine reservoir could have erupted after an impact and spread through Europa's porous surface ice.

Europa has long been of interest to both scientists and science fiction writers in terms of its potential habitability.[5] The current study, based on data supplied by the Galileo spacecraft in 1998, represents another step in the quest to determine whether Europa's subsurface ocean might support some kind of life. "Using numerical modelling of the brine reservoir, we obtained constraints on the reservoir potential depth (up to 3.7miles below the surface) and lifetime (up to a few thousands of years post-impact)," Lesage said. "This is valuable information for future missions looking for habitable environments within icy shells."[6] Indeed, the science team is avidly awaiting higher-resolution imagery from the Europa Clipper mission, a NASA spacecraft scheduled to arrive at the Jupiter system in April 2030.

Until next month,

Grace

Grace Wolf-Chase (she/her/hers)

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[1] https://www.psi.edu/staff/profile/elodie-lesage/
[2] https://iopscience.iop.org/article/10.3847/PSJ/ae18a0
[3] https://www.psi.edu/blog/europas-spider-like-features-and-the-potential-for-life/
[4] https://astrobiology.com/2025/12/europas-spider-like-features-and-the-potential-for-life.html
[5] e.g., see https://www.theclergyletterproject.org/pdf/abnews112018.pdf and https://www.theclergyletterproject.org/pdf/abnews122019.pdf
[6] https://www.psi.edu/blog/europas-spider-like-features-and-the-potential-for-life/

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