

BBC



APOLLO 17: THE FINAL LUNAR LANDING & ITS LEGACY

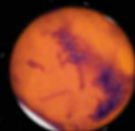


#211 DECEMBER 2022

Sky at Night

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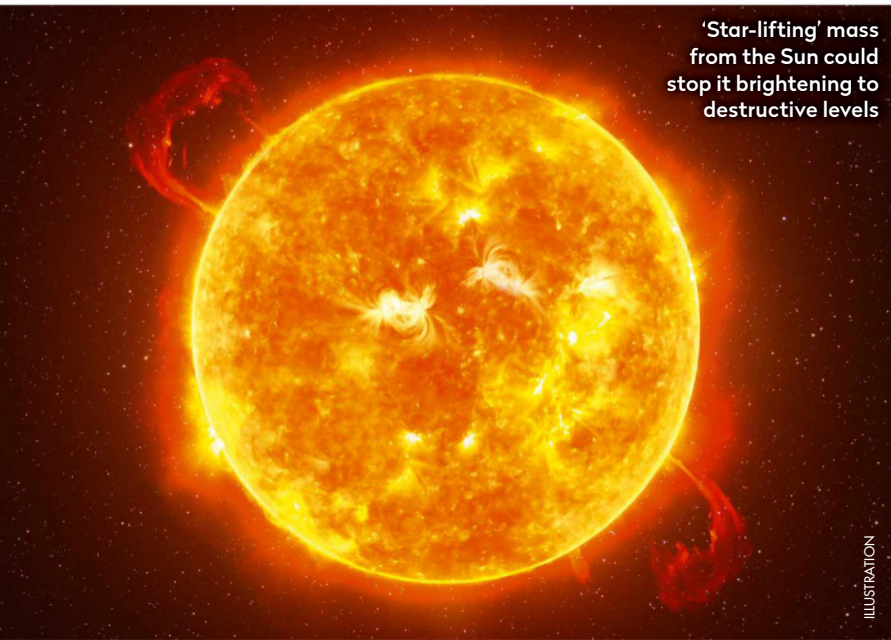
DART'S ASTEROID IMPACT: EXAMINING THE RESULTS

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Our experts examine the hottest new research

CUTTING EDGE



Taking chunks from the Sun to save the world

Could reducing the Sun's mass save the far-future Earth from destruction?

There is a cosmic limitation facing life on Earth, as our Sun steadily brightens through its lifetime on the main sequence before ballooning into a red giant. This planet-sterilising red giant phase won't begin for another five billion years or so, so a natural question might be what could we do in the distant future to try to preserve the habitability of our world? Various high-concept proposals have been put forward, including a carefully orchestrated programme of flinging asteroids past Earth to boost the planet into a more distant orbit as the Sun brightens, exploiting the same physics as the gravitational slingshot method used to propel space probes.

Matthew Scoggins and David Kipping, both at Columbia University's department of astronomy in New York, have been investigating another ultra-long-term, high-tech possibility. One way for an advanced civilisation to counteract the brightening of their star as it ages is to progressively remove mass from it and so slow the rate of fusion reactions in its

core. Scoggins and Kipping dub such artificially engineered suns 'Lazarus stars', after the biblical figure raised from the dead. Although they note that this method of 'star-lifting' was proposed by David Criswell back in 1985, here the authors have actually done the numerical calculations to work out exactly what would be needed.

Stellar smash and grab

They considered two slightly different scenarios. The first keeps the Sun at a constant brightness, or isoluminosity, by stripping mass from it and then storing it in orbit between Earth and the Sun. The second approach maintains the same amount of sunlight falling on Earth – iso-irradiance – by removing less solar mass at first but then ejecting it out of the Solar System so that the orbit of the planet also drifts outwards with the reduced gravitational hold.

Scoggins and Kipping calculate that changing the planet's orbit with the iso-irradiance approach can extend the Sun's lifetime on the main sequence – and thus the potential for life on Earth – by around six billion years. Doing so would require lifting a solar

mass equivalent to two per cent that of the largest asteroid, Ceres, every year.

The isoluminosity approach, which stores the removed mass, would require more to be stripped away at first, but could extend life on Earth by 10 billion years.

Such a cosmic engineering project would require prodigious amounts of energy – the equivalent to 10 billion times the current annual energy consumption of our entire global civilisation. The iso-irradiance method

would need 100 times more than even that to eject the material from the Solar System. But as the researchers point out, the Sun is itself an enormous source of energy and an advanced civilisation would only need to capture 0.03 per cent of its annual output to power such an exercise.

Although they don't attempt to speculate on what sort of advanced technology might enable this kind of stellar engineering, this study does offer an intriguing glimpse into what the far future of humanity may hold in store.

“Changing the planet's orbit can extend the Sun's lifetime – and thus the potential for life on Earth – by around six billion years”



Prof Lewis Dartnell is an astrobiologist at the University of Westminster

Lewis Dartnell was reading... *Lazarus Stars: Numerical Investigations of Stellar Evolution with Star-lifting* by Matthew Scoggins and David Kipping. **Read it online at:** arxiv.org/abs/2210.02338