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## CLEOsat Statement on Bluewalker 3

— Global astronomy community troubled by unprecedented recent launch of BlueWalker 3

The Chilean Low Earth Orbit satellite (CLEOsat) group expresses its concern about the recent launch of the prototype BlueWalker 3 satellite — which is now one of the brightest objects in the night sky — illustrates the growing challenge these satellites pose to the global scientific community.



Panorama photos of Bluewalker 3 from Observatorio Astronomico Nacional, San Pedro Martir, Mexico from 12th November (top) and 14th November (bottom) 2022. Images courtesy of Ilse Plauchu-Frayn.

On 10 September 2022 [AST SpaceMobile](#) launched a prototype satellite called BlueWalker 3 into low Earth orbit. This satellite, which has a 64-square-metre antenna system (the largest commercial antenna system ever deployed into low-Earth orbit), is the first of what is expected to be a couple of hundred larger satellites called Bluebirds. In coordination with the new International Astronomical Union Centre for the Protection of the Dark and Quiet Sky from Satellite Constellation Interference ([IAU CPS](#)) – of which CLEOsat is a member – the CLEOsat group coordinated new measurements by observers in Chile, Mexico, and Morocco, that show that this satellite has become one of the brightest objects in the night sky — brighter than the visible Starlink satellites and at times, almost nearly as bright as the 15th brightest star, Antares [1]. In addition to the amount of sunlight they will reflect back to Earth, these satellites are proposed to work as “cell-phone towers in space,” utilising the same

frequencies as terrestrial cell-phone networks, and they could increase the level of artificial radio noise seen by radio telescopes looking at the invisible Universe at some radio wavelengths.

CLEOsat and its partners wish to state their concern over this recent development. The Universe is a unique laboratory, which allows us to conduct experiments that provide insights into fundamental physics and other research at the boundaries of our knowledge, insights that would never be possible to recreate on Earth. Furthermore, the pristine night sky is an important aspect of humanity's shared cultural heritage, and should be protected for society at large and for future generations.

*"BlueWalker 3 is a big shift in the constellation satellite issue and should give us all reason to pause"* said Piero Benvenuti, Director of the IAU CPS.

During an intensive week of observations using the 0.6m Chakana telescope at the [Ckoirama observatory](#) (owned and operated by the Universidad de Antofagasta), the Deca-Degree Optical Transient Imager (an array of six 28cm telescopes), [Observatorio Astronómico Nacional](#) in Mexico and telescopes at the [Oukaïmeden Observatory](#) (also a member of the IAU CPS), observations of Bluewalker 3 were taken prior, during, and after the array unfurled. These images are being analysed and show a marked increase in brightness of Bluewalker 3, now that the 64-square-metre array is fully open.

*"Bluewalker 3 is a paradigm shift in LEO communication satellites. In an effort to provide orbital 4G and 5G mobile coverage, Bluewalker 3 is designed to have the largest antenna ever sent into orbit, greatly increasing its reflectivity of Sun light and making it one of the brightest objects in the night sky"* said Jeremy Tregloan-Reed, Director of CLEOsat and assistant professor at the Universidad de Atacama.

CLEOsat and its members acknowledge that the new satellite constellations have an important role in improving worldwide communications access. However, their interference with astronomical observations could severely hamper progress in our understanding of the cosmos. Their deployment should therefore be conducted with regard to potential side effects and sincere efforts made to minimise their impact on astronomy.

## Notes

[1] The measurements show that BlueWalker 3 is around apparent magnitude 1 at its brightest. Apparent magnitude in astronomy is a measure of the brightness of a star or other astronomical object as observed from Earth. The scale is reverse logarithmic: the brighter an object is, the lower its magnitude number. The brightest astronomical objects have negative apparent magnitudes: for example, Venus at -4.2 or Sirius at -1.46. The faintest stars visible with the naked eye on the darkest night have apparent magnitudes of about +6.5. This places Bluewalker 3 almost as bright as Antares or Spica, the 15th and 16th brightest stars in the entire night sky.

## More information

In september 2021 a group of Chilean astronomers founded the Chilean Low Earth Orbit satellite (CLEOsat) group, with the endorsement of the Chilean Astronomical Society (SOCHIAS) and is formed by members of the Chilean astronomical community (faculty, researchers, postdocs, and students) from several national universities as well as international observatories operating in Chile. The lead astronomer of the group Dr Jeremy Tregloan-Reed, an assistant professor at the Universidad de Atacama was the PI of the successful observations of SpaceX's first reflective brightness mitigation design, Darksat and deduced that the special "darkening" treatment reduced the reflective brightness by 55%, which still allowed Darksat to be seen by the unaided eye in dark sky conditions.

**The CLEOsat group's primary mission is to assess the impact of LEO constellation communication satellites on the night sky, and their effects on optical and radio astronomy.** The CLEOsat group has access to telescopes in Chile, Europe, and Asia which are performing observations of LEO constellation communications satellites to aid in the primary mission. The

CLEOsat group understands the importance and necessity of providing high speed internet to communities, lacking such services and through collaborating with other international groups, **the CLEOsat group is working on mitigation software** to aid both the professional and amateur astronomical communities in Chile and internationally therefore, helping to reach a compromise so that we can all continue to enjoy dark skies.

This statement is in coordination with the <https://www.iau.org/news/pressreleases/detail/iau2211/>

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### Astronomical images:



Observation using the 0.6m Chakana telescope from Ckoirama observatory, Antofagasta Chile - owned and operated by the Universidad de Antofagasta. A five second image taken at 23:56 UT on 2022-11-10. The image shows Bluewalker 3 and a second object, believed to be debris from the beginning of the unfolding of the array. The measured apparent magnitude in this early stage was  $V=6.2$  for Bluewalker 3 and  $V=6.4$  for the second object. **Image credit: Eduardo Unda-Sanzana, Christian Adam, and Juan Pablo Colque.**



Observation from Oukaïmeden observatory, Morocco. A two second image taken at 05:30:13 UT on 2022-11-16. The image shows a bright trail of BW3 after it has completed its unfolding of the array. The bright star lower left is Zeta Puppis a  $V = 2.25$ , a O4 blue giant. The satellite was at a distance of 1225 km when the observations were conducted and hence not at maximum brightness. The brightness in the image corresponds to an apparent magnitude of 3. **Image Credit: Oukaïmeden observatory, Observer: Aziz Ettahar Kaeouach.**