Galaxy alignments traced back ten billion years

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A new study based on observations with the Hubble Space Telescope has shown

that the most massive galaxies in the universe have been aligned with their surroundings for at least ten billion years. Credit: ESA/Hubble, NASA, HST Frontier Fields.

A new study led by Michael West of Lowell Observatory reveals that the most massive galaxies in the universe have been aligned with their surroundings for the past ten billion years. It is the furthest back in time that this phenomenon has ever been seen.

While most galaxies are randomly oriented in space, astronomers have long known that the biggest ones often point towards their neighbors. But when and how these alignments occurred remains a mystery. Looking to the past can shed new light on the origin of galaxy alignments.

To peer across cosmic time, West and an international team of collaborators used the Hubble Space Telescope to observe 65 giant galaxies whose light has taken billions of years to reach earth. The team found that the most massive galaxies were already aligned with their surroundings when the universe was only 1/3 of its current age.

"It's an important new piece of the puzzle," says West, "because it says that whatever caused these alignments happened early."

There are different theories for why such alignments occur. One is that giant galaxies grow by accreting smaller neighbors along preferred directions that reflect the cosmic web, a vast network of filaments connecting galaxies on large scales. Another theory suggests that, given enough time, gravity's relentless tug will slowly reorient the largest galaxies until they are aligned with the surrounding distribution of galaxies. While the discovery of galaxy alignments at early epochs does

not rule out either scenario, it does place increasingly tight time constraints.

West and team are eager to look further into the past by observing more remote galaxies, which will allow them to see if there was a time before they were aligned. But studying galaxies at the dawn of time is not easy, even with Hubble. According to West, "We're trying to measure the shapes and orientations of galaxies that appear very faint and very small because of their great distances, which is challenging."

In addition to West, the team consists of Roberto De Propris of the University of Turku, Malcolm Bremer and Steven Phillipps, both at the University of Bristol.

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More information: Michael J. West et al. Ten billion years of brightest cluster galaxy alignments, *Nature Astronomy* (2017). DOI: 10.1038/S41550-017-0157

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