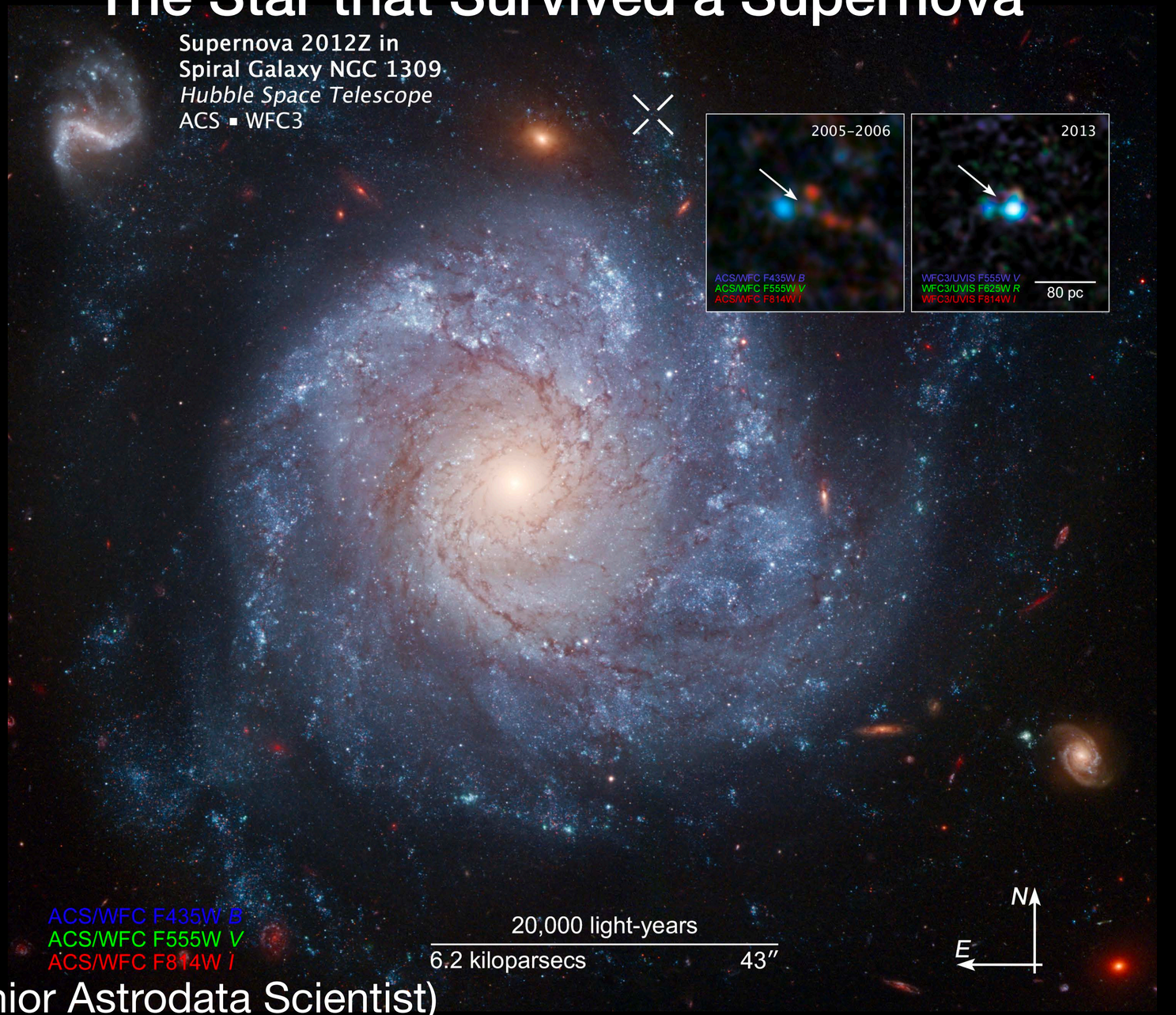
The Star that Survived a Supernova



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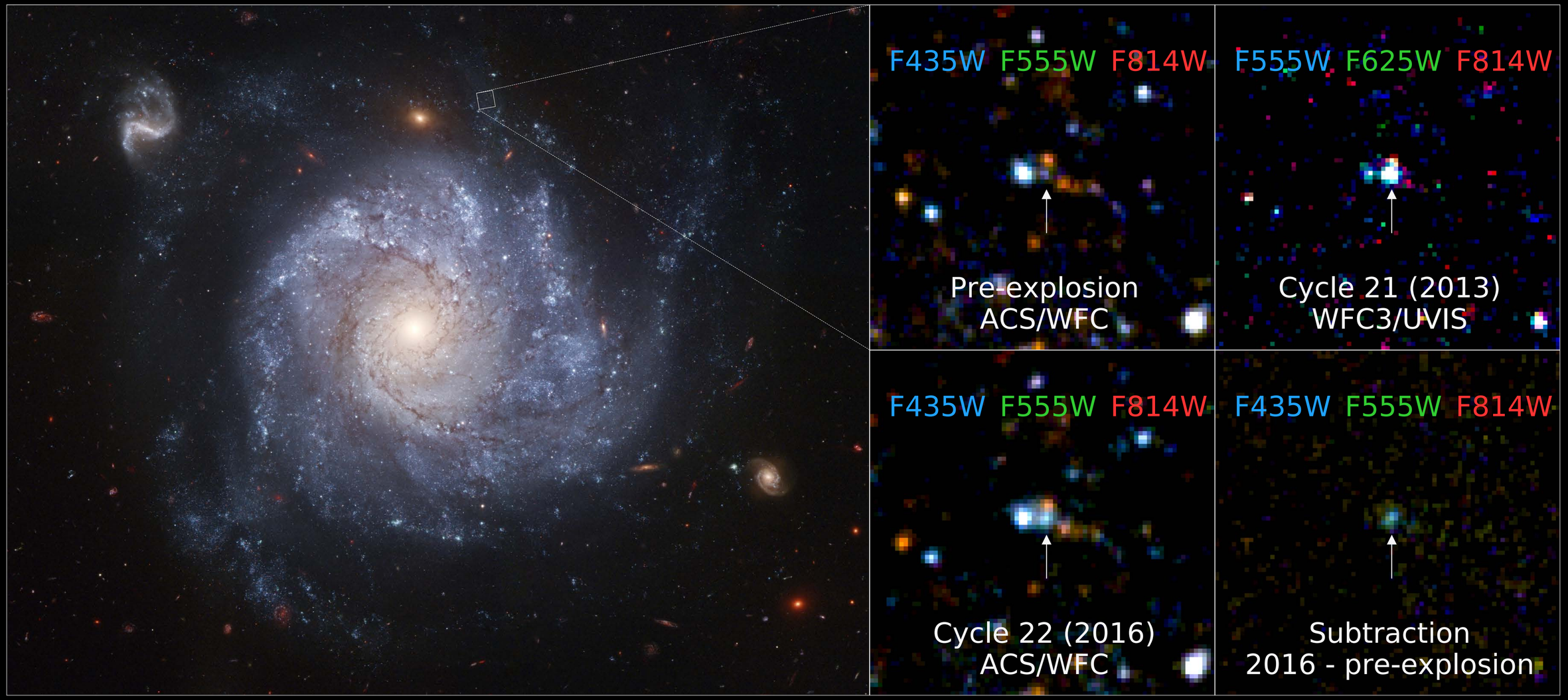
Las Cumbres **Observatory**

When we revisited the site of the supernova 2012Z, we were surprised to find that the star that exploded was not destroyed. It survived!

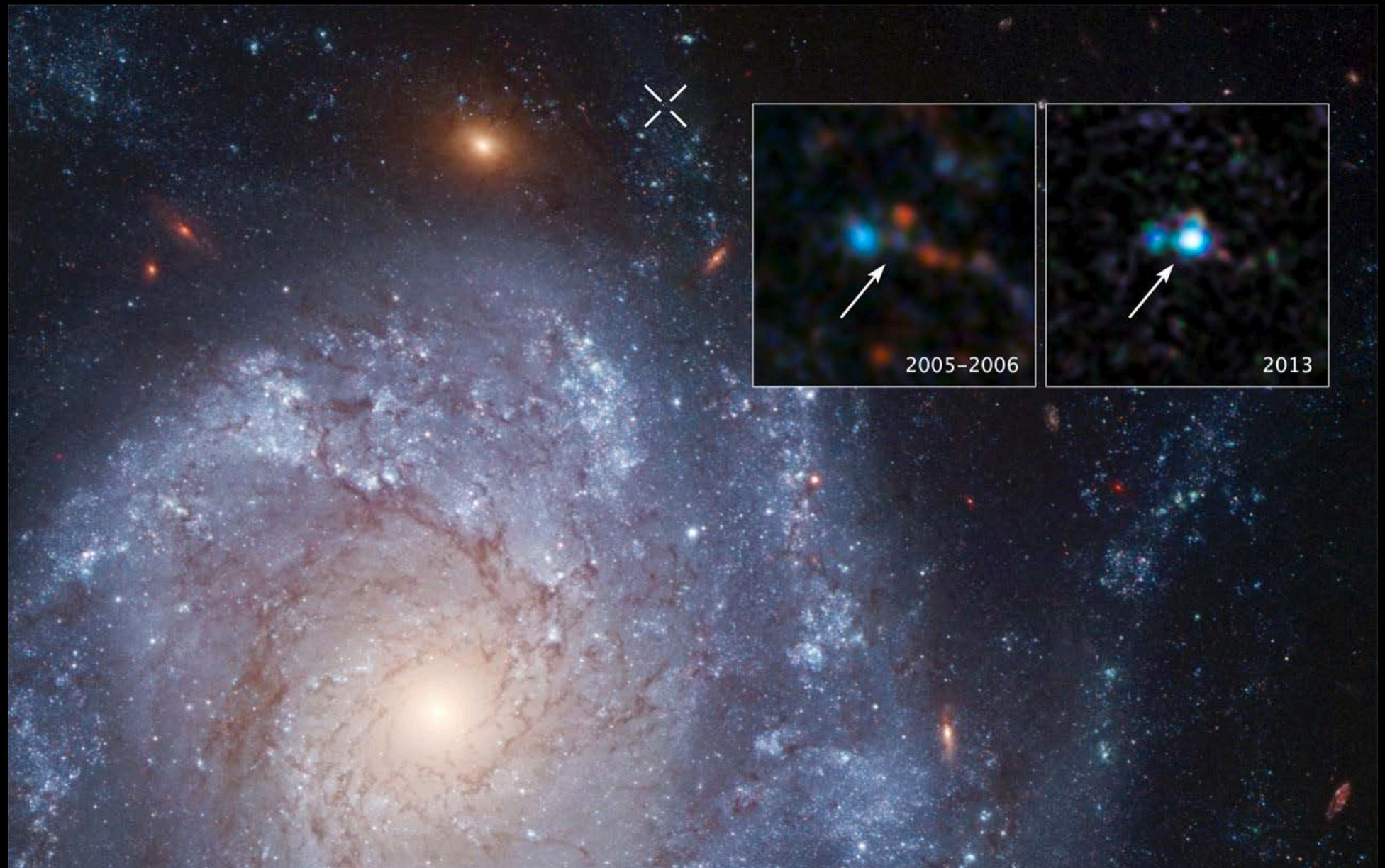


Ten years before SN 2012Z, SN 2002fk was discovered in the spiral galaxy NGC 1309

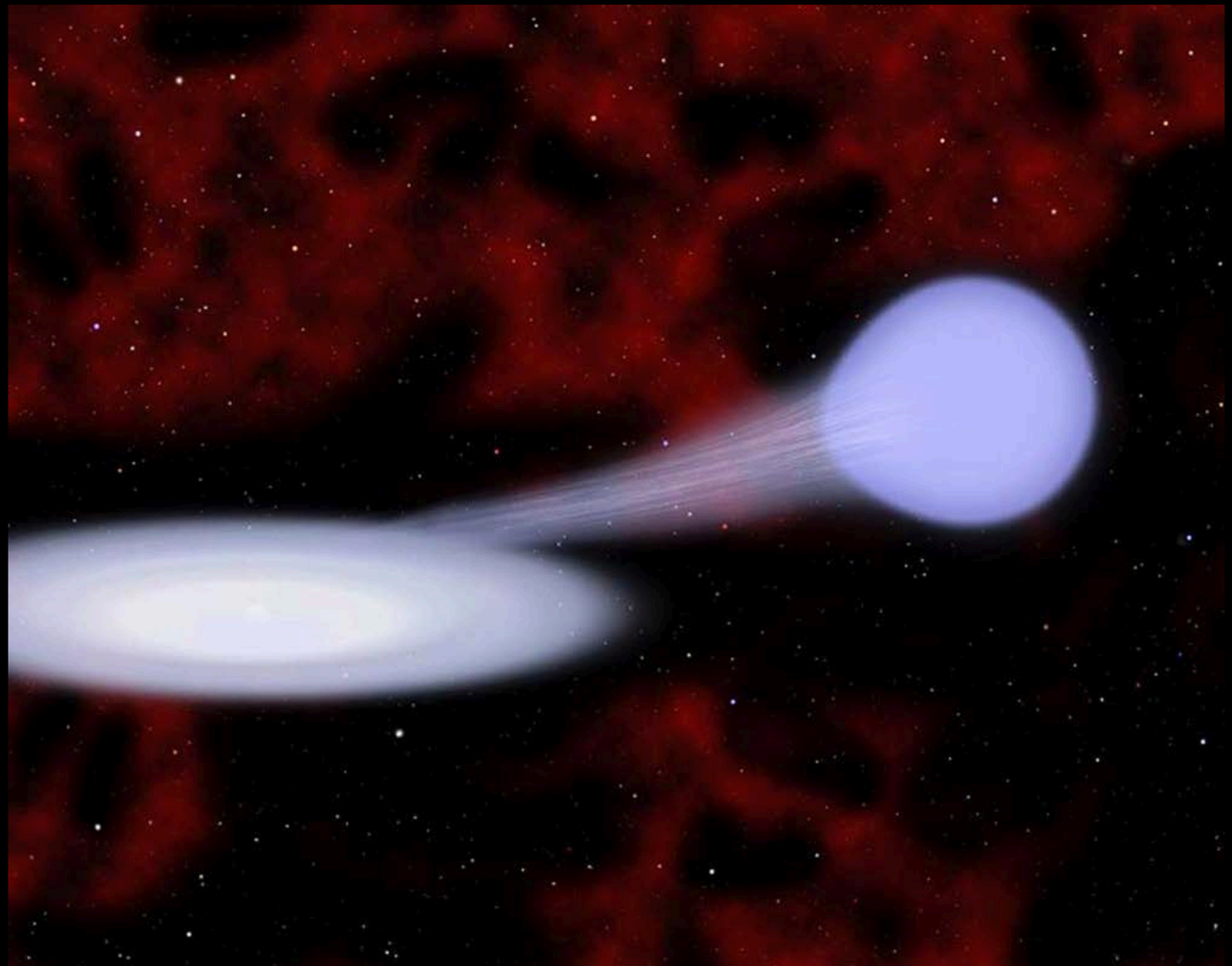
To further study SN 2002fk, deep Hubble Space Telescope observations were taken between 2005 and 2006.

SN 2012z, a peculiar white-dwarf supernova was discovered in the same galaxy. The previous images we had taken allowed us to look for the star that exploded.

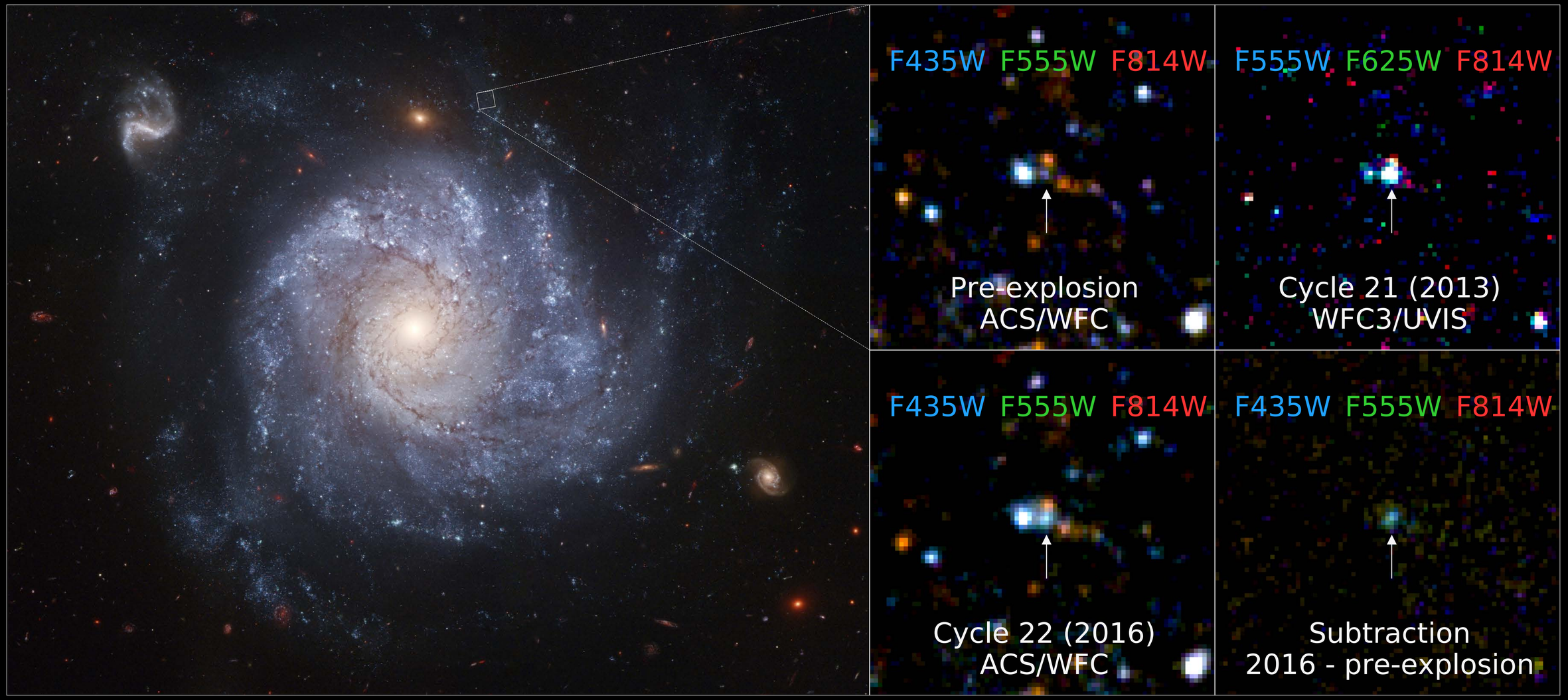
Using data from 2013, we aligned the images to the reveal the star that exploded, a first for white-dwarf supernovae.



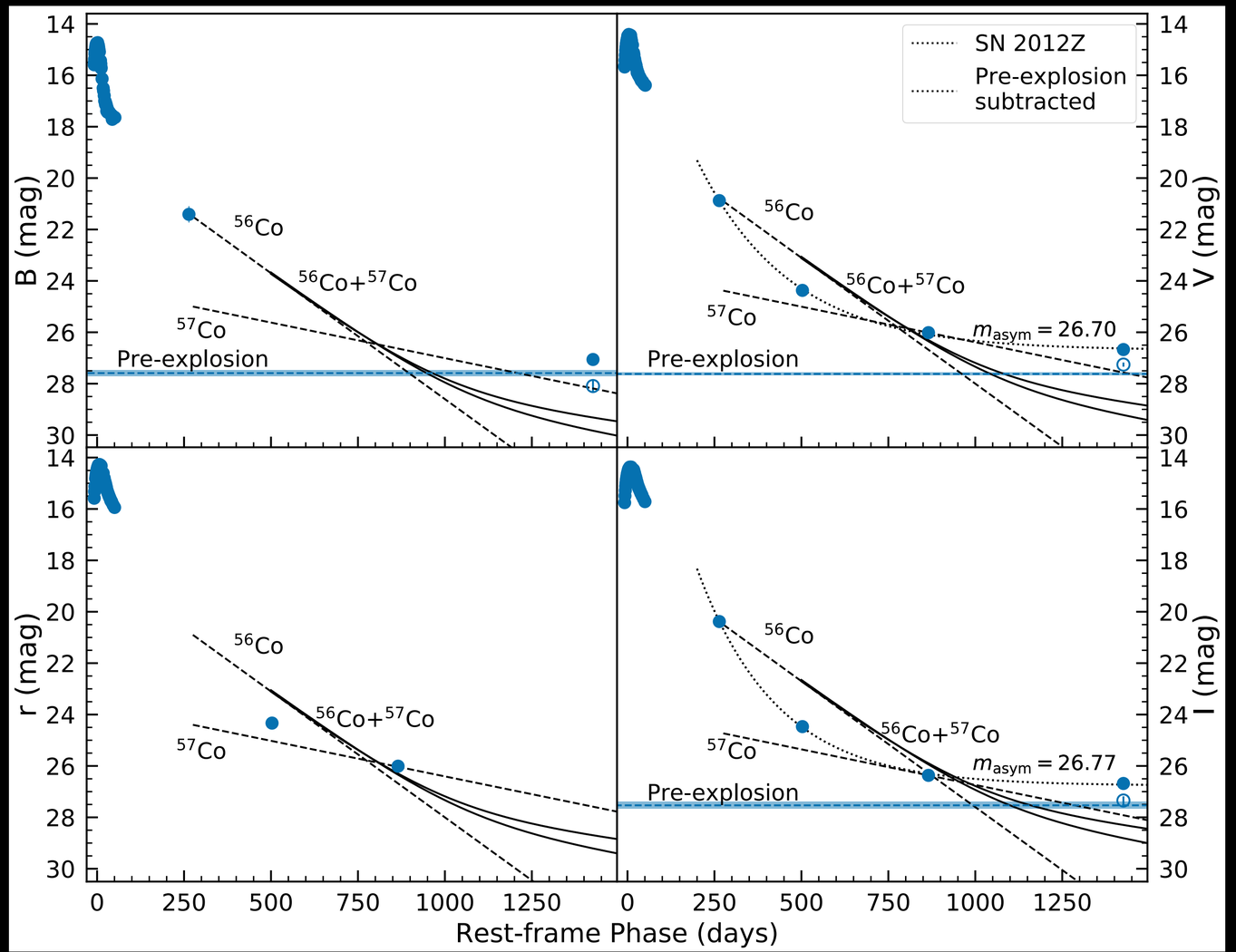
The source in the pre-explosion image was likely a combination of the companion star that was donating mass to white dwarf and the disk of material around the white dwarf.



We went back and observed the supernova years after it exploded expecting it to have faded away. Surprisingly, the supernova was still brighter than the progenitor system was before the star exploded.

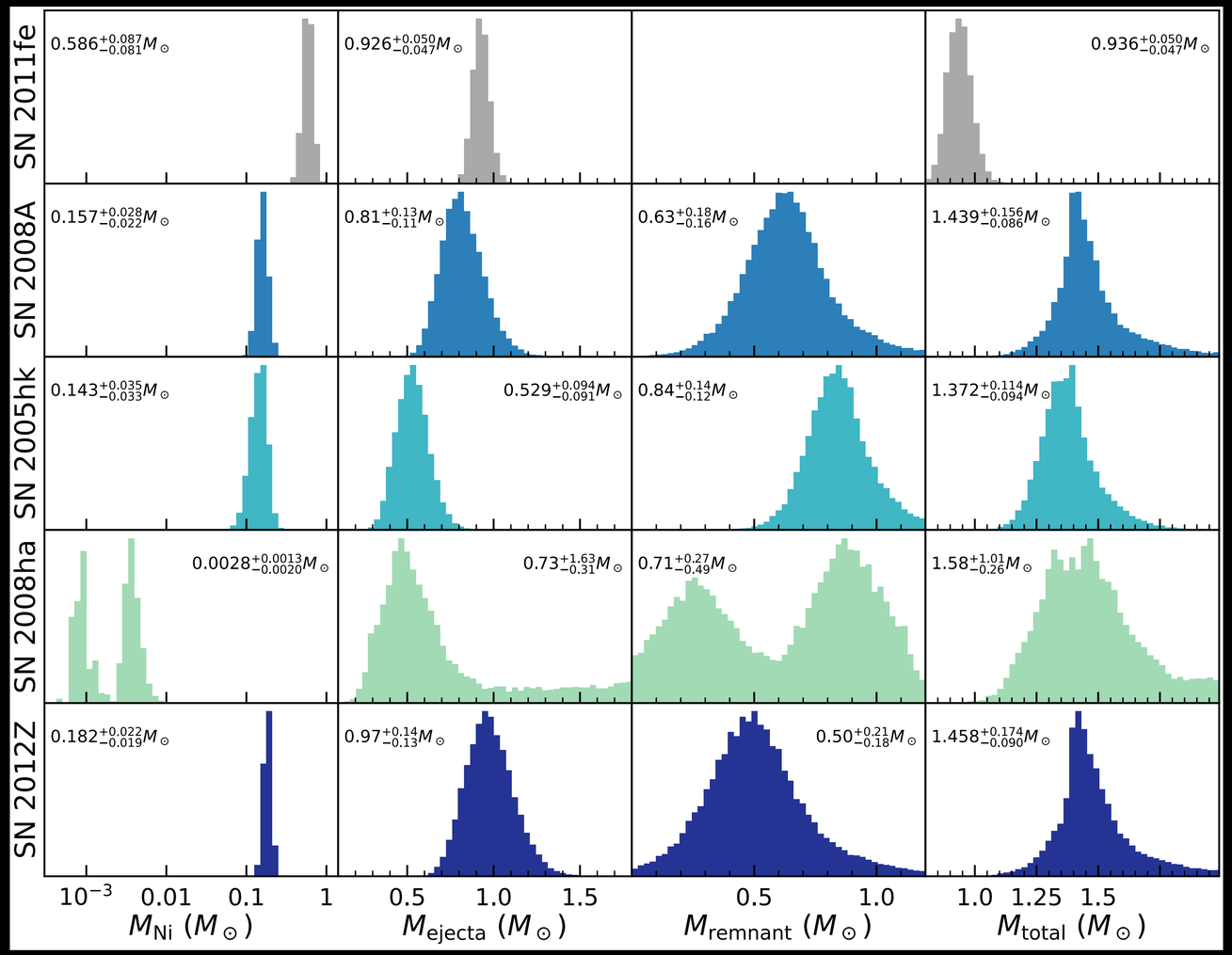


In all bands, SN 2012Z has stopped declining. The light curve is significantly brighter in all bands than would be expected from standard supernova physics.

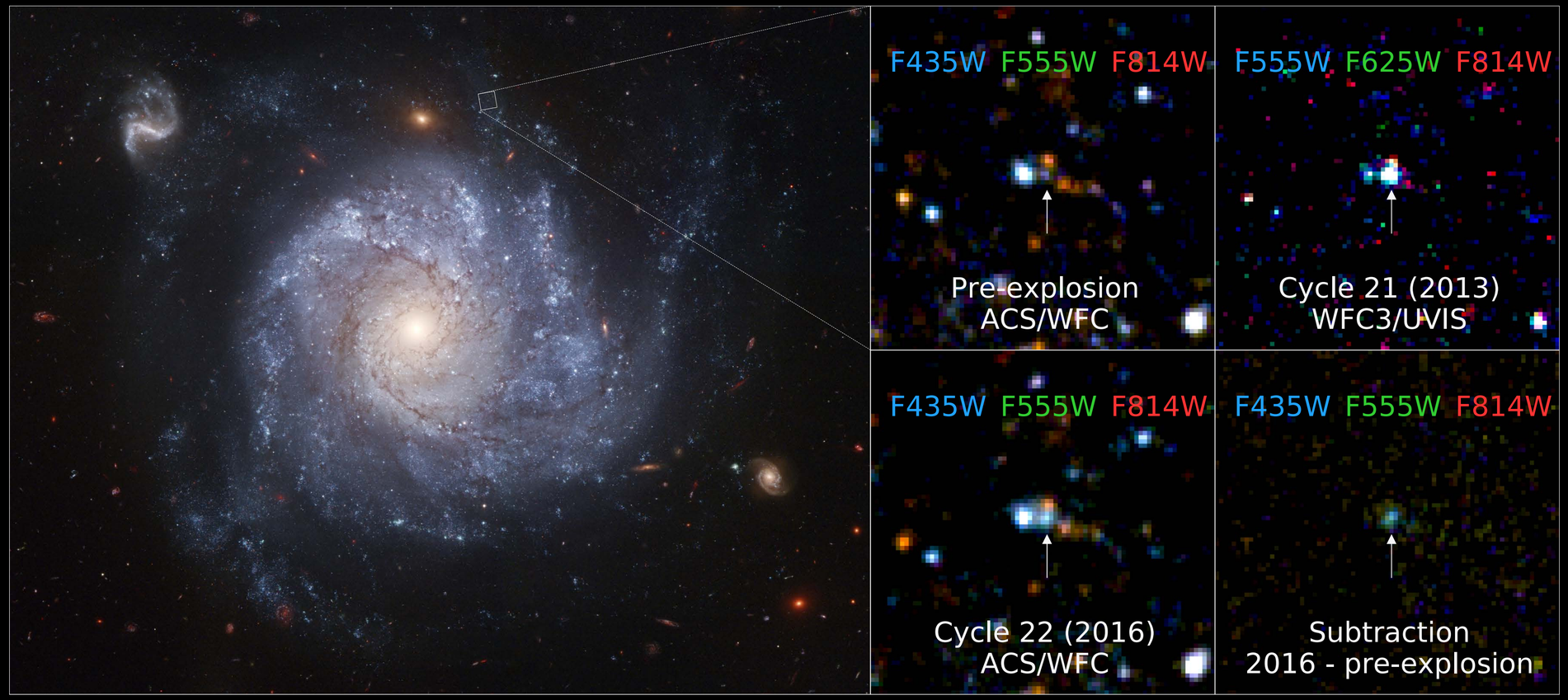


The best explanation for why the supernova has not faded as expected is that we are seeing a combination of the shell of material that was ejected from the white dwarf and a heated remnant of the white dwarf that did not fully explode.

Our models suggest that this whole subclass of peculiar white-dwarf supernovae explode at the Chandrasekhar mass. Our models, along with other studies, suggest normal white-dwarf supernovae explode at lower masses contrary to conventional wisdom.



SN 2012Z did not fade as expected. Instead it appears we are seeing the leftover remnant of the explosion.



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