

OBSERVING

POP GOES THE BALLOON!

What Happens when a Weather Balloon Reaches 30,000 m asl?

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Did you ever wonder what happens when a rubber weather balloon reaches maximum altitude and bursts? A weather balloon carrying a radiosonde or ozonesonde released at the Earth's surface is generally about 1.5 m in diameter at launch. At 30,000 m asl it has expanded to about 10 m in diameter and bursts at temperatures often colder than -40°C , sometimes as cold as -75°C . With a volume 100 times greater than when the balloon was released at ground level, the deflation is not a gentle leak but an explosion!

The sequence of photos on the opposite page of an exploding rubber weather balloon were taken with a GoPro Hero4 Black camera with a resolution of 1,920 x 1,440 pixel frames operating at 48 frames per second. As such, the time between each frame is

0.02 seconds. The camera was suspended 10 m below the balloon, which burst at 29,690 m asl and -50°C . The camera was returned to Earth on a biodegradable plastic parachute used with sonde launches. A GPS on the radiosonde allowed for recovery of the sonde and camera launched from near Boulder, Colorado.

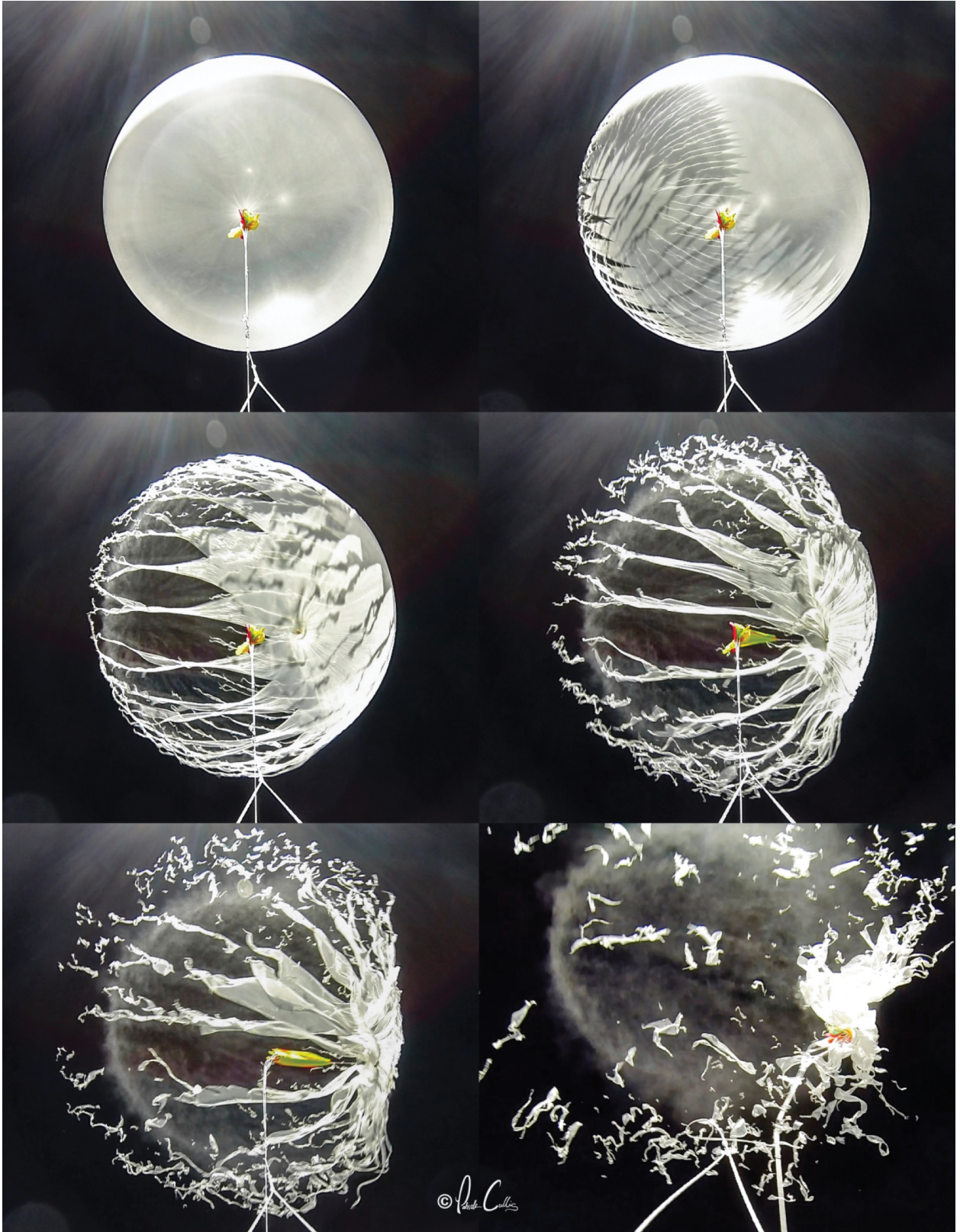
As seen in the photos, the balloon begins to shatter at a single point and rapidly shreds symmetrically toward a focus on the opposite side. The ghost image is powder used in the manufacturing process to keep the inner walls of the balloon from sticking together before inflation. Photos of six other balloon bursts show similar point failure with the shredding rubber contracting to a mirror point on the opposite side of the balloon. The time between the first and last of the six frames is 0.1 seconds.

Weather balloons are reliably manufactured to high standards, and greater than 90% burst between 13 and 9 mb. This corresponds to 29–32-km altitude, respectively, in the midlatitudes. In the high Arctic and in Antarctica where there is no sunlight in winter and the stratosphere becomes extremely cold, the rubber balloons become brittle and burst close to 125 mb at 15-km altitude. During the polar winter season, more expensive, large plastic balloons are used that reach the same altitudes as the rubber balloons in the midlatitudes.

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A typical rubber weather balloon bursting at 29,690 m asl over Colorado at -50°C . The time between each frame is 0.02 seconds.