What is The Highest Known Temperature?

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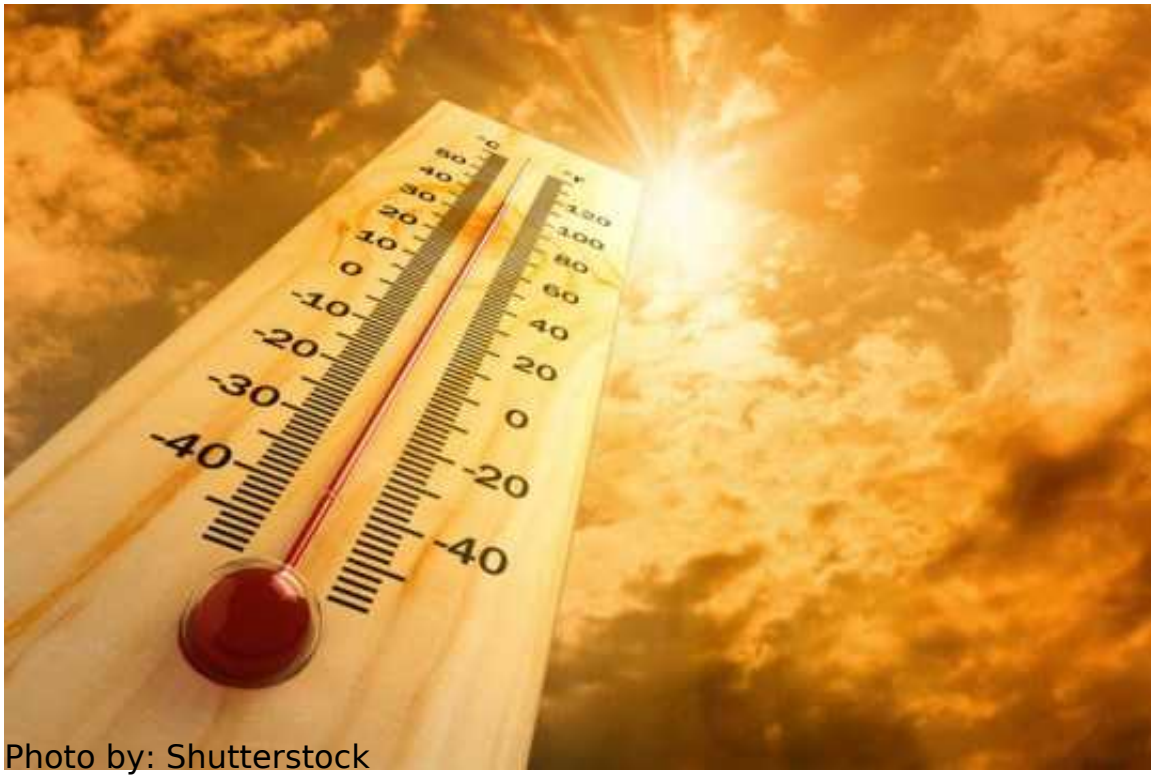

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QUESTION:

“What is the highest known temperature?”

Asked by: Taylor Sullivan

ANSWER:

Every atom in the universe likes heat. They like heat so much that atoms and subatomic particles vibrate and move around when they’re hot. The hotter they are, the faster they move, and the colder they are, the slower they move. In fact, at absolute zero (0 Kelvin, −273°C, or −460°F), all movements from the atoms stop completely. You can’t get colder than that. It’s like trying to go south from the South Pole, or north from the North Pole; not only won’t it happen, it can’t.

The hottest thing that we know of (and have seen) is actually a lot closer than you might think. It’s right here on Earth at the Large Hadron Collider (LHC). When they smash gold particles together, for a split second the temperature reaches 7.2 trillion degrees Fahrenheit! That’s hotter than a supernova explosion.

But Can We Go Hotter?

Theoretically, yes. The first contender for the hottest temperature is the Planck Temperature, which equals 100 million million million million million degrees, or 1032 K. You just can’t put this kind of temperature into perspective. There’s simply no way to wrap your head around this number. Saying that 1032 K is hot is like saying that the universe takes up some space. (The BBC has a good infographic on the hot and cold extremes, but it’s too large for our site)

This is as hot as you can get in normal physics, because once it gets any hotter, conventional physics just doesn’t work. Weird things happen. Gravitational force becomes as strong as the three other natural forces (electromagnetism, and the strong and weak nuclear forces), and they merge together into one unified force. Understanding how this happens is referred to as the “theory of everything”, the holy grail of modern theoretical physics.

Another contestant for the hottest temperature in the universe comes courtesy of string theorists, who say that it is 1030 K, a little cooler than the contestant above. String theorists believe that the most basic things in the universe aren’t particles, but vibrating strings. They have reason to believe that the maximum temperature achievable is just a bit cooler that the Planck temperature.

You may have heard of the existence temperatures lower than absolute zero; however, negative temperatures are not colder than absolute zero. In fact, negative Kelvin temperatures are hotter than infinite temperatures, and can only happen in systems that have an energy ceiling, and usually only discrete (quantised) systems have that. For more information, check out our article, “Is Absolute Zero Absolute?“

The reason they define the temperatures in this way is because of the mathematical niceness in the formulation of statistical thermodynamics. Also, we have had access to negative temperatures since very long ago, just that we have never reached temperatures so hot.

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