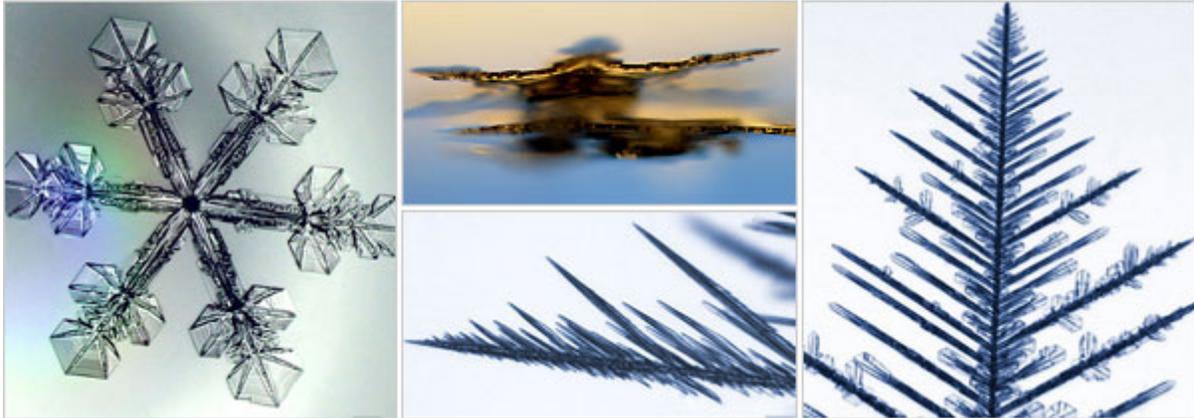


## Snowflakes as Big as Frisbees?

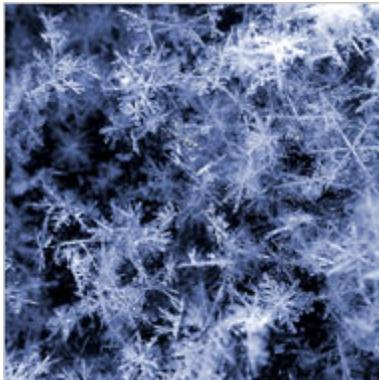


All photographs except center top by Kenneth Libbrecht/From "The Snowflake" (Voyageur Press); center top, Patricia Rasmussen/From "The Snowflake"

**Snow crystals can join together to become a snowflake, or they can fall by themselves. They come in a relatively small number of basic shapes, including prisms, columns, stars, cups, plates, bullets and needles.**

**By WILLIAM J. BROAD  
Published: March 20, 2007**

Since at least the 19th century, people have periodically claimed to see giant snowflakes falling from the sky — big ones the size of saucers and plates or even larger, their edges turned up, their heaviness making them descend faster than small flakes.



Kenneth Libbrecht/From "The Snowflake" (Voyageur Press)

**Dendrites can lock branches to form larger flakes, as seen on a car windshield.**

But the evidence was always sketchy and, because of the fragile nature of snowflakes, fleeting. The giant flakes were not quite in the category of sea monsters or U.F.O.'s. Even so, skeptics noted the human fondness for exaggeration, as well as the lack of convincing photographs. And the organizations that compile weather records never made tracking big flakes an observational requirement. So the giants

languished in a twilight world of science, their existence claimed but seldom documented.

Now, theorists, weather historians and field observers are concluding that most of the reports are true and that unusually large snowflakes two to six inches wide and perhaps wider fall regularly around the globe, surprisingly big and fluffy, if seldom witnessed or celebrated. Guinness World Records lists the largest snowflakes as having fallen during a storm in January 1887 at Fort Keogh, in Montana. A rancher nearby, the book says, called them “larger than milk pans” and measured one at 15 inches wide. But no corroborating evidence supports the claim.

“Who of us has seen a hailstone the size of a golf ball or a baseball?” asked Kenneth G. Libbrecht, a snowflake devotee at the [California Institute of Technology](#) who runs the physics department there in his spare time. “But, clearly, they exist, because people pull them out of their freezers. Some of these things can be very, very rare, but not impossible.”

So too with giant snowflakes, Dr. Libbrecht said. “As big as a basketball?” he asked. “Who knows? It’s not out of the question.”

The laws of physics, he said, suggest no obvious restrictions on the size of very large flakes. But in the real world, Dr. Libbrecht added, wind might break up the fragile compilations, putting an effective size limit on what flutters down from the sky.

Some of the new interest stems from weather historians who have scrutinized old reports and found recurring claims of giant snowflakes. At times, they say, independent observers of the same storm have corroborated the extraordinary falls.

William S. Pike, a British weather observer for the Royal Meteorological Society, found 11 poorly known reports, which he described in *The Journal of Meteorology* in January 1988. He wrote that reliable observers of big flakes estimated their diameters at anywhere from two to six inches.

“There is every reason to suppose that such instances might occur almost every day during winter somewhere in Europe or the maritime fringes of North America and Asia,” he said. But, he added, such extraordinary snowfalls “are seldom reported or authenticated.”

In an interview, Mr. Pike said he got into the topic partly because he himself watched in amazement one day in Vancouver, British Columbia, as giant snowflakes began to

transform the winter landscape. “They were two or three inches across,” he recalled. “So I became a believer, having once witnessed it myself.”

He added that scientists were starting to understand the atmospheric conditions that give rise to big flakes and that this knowledge presented an opportunity for enthusiastic amateurs.

“Any kid with a ruler and a camera can make a contribution,” he said. “If they see something special, it’s worth recording and talking about. After all, records are meant to be broken.”

More by accident than design, scientific field studies in recent years have begun to document the existence of very large flakes with laser probes that can make precise measurements. Two expeditions in the Canadian wilds have done so from airplanes flying through heavy winter storms.

In the future, [NASA](#) and its international partners are to join the hunt for giant snowflakes with satellites that measure global precipitation, including snowfall. The work is seen as crucial for climate studies. The first satellite is to fly in 2013, at an overall mission cost of roughly \$1 billion.

“For the first time, we’ll be able to make a good estimate of the snowfall rate and potentially of snowflake sizes, including the presence of very large flakes,” said Walter A. Petersen, a senior research scientist at the [University of Alabama](#), Huntsville, who is working on what is known as the Global Precipitation Measurement mission. “It’s a big deal.”

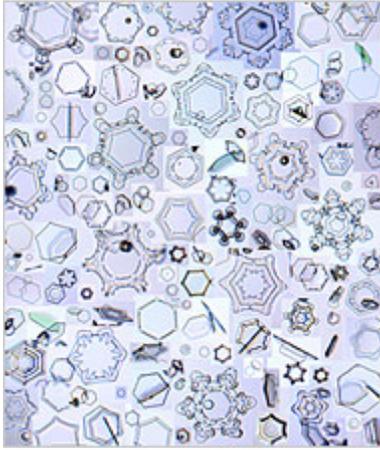
### **Tips**

To find reference information about the words used in this article, double-click on any word, phrase or name. A new window will open with a dictionary definition or encyclopedia entry.

### **Past Coverage**

- DAY TRIPS; A Place Where All the Snowflakes Are Still Different (January 2, 2004)
- Falling Physics, When the Weather Outside Is Frightful (December 23, 2003)
- For Snow, the Real Action Begins After It Falls (February 9, 1988)
- SNOWFLAKE'S RIDDLE YIELDS TO PROBING OF SCIENCE (January 6, 1987)

**Dr. Petersen said understanding snowflake sizes and shapes was important because big ones, if unaccounted for in the global measurements, could fool space sensors into overestimating the amount of precipitation.**



Kenneth Libbrecht/From "Ken Libbrecht's Field Guide to Snowflakes" (Voyageur Press)  
Snow crystals that were grown in a laboratory.

The usual image of a snowflake — a perfect star with six arms, the kind found on ski sweaters and holiday cards — is actually a single snow crystal. As Dr. Libbrecht of Caltech notes in his book "The Snowflake" (Voyageur Press, 2003), the word snowflake is a general term that can refer to a single ice crystal, a small cluster of them or a large aggregation that forms when crystals "collide and stick in midair, falling to earth in a flimsy puffball."

Hundreds or perhaps thousands of crystals will come together to form a giant snowflake, scientists say. But it turns out that even a single crystal can be surprisingly large.

Dr. Libbrecht, who grew up on a farm in North Dakota and fell in love with snow at an early age, now specializes in studying and photographing snow crystals. In an interview, he mentioned how in his 2003 book he described the biggest snow crystals found in nature as about the size of a pea.

After that, he said, he was on field study in northern Ontario when he found himself surrounded by star-shaped crystals falling from the sky that were the size of dimes. "They were huge," he recalled. "It was very impressive."

Dr. Libbrecht features one of the giants in "Ken Libbrecht's Field Guide to Snowflakes" (Voyageur Press, 2006). "It's quite a sight," he wrote, "to see such enormous ice flowers drifting through the air and landing on your sleeve!" (In his laboratory, he has managed to grow single crystals even larger, up to an inch wide.)

Snow crystals, despite their legendary diversity, come in a relatively small number of general shapes, including prisms, columns, stars, cups, plates,

bullets and needles. Technically, the big crystals that Dr. Libbrecht observed in Canada are known as dendrites, from the Greek word for tree, because their arms are quite elaborate, like branches thick with leaves or flower stems rich in petals. Dendrites are the largest snow crystals.

Scientists have found that dendrites have a tendency to join together faster than their simpler relatives. Their complicated arms, it appears, more easily form bonds. "As the branches interlock," said Dr. Petersen of the University of Alabama, "you get these huge aggregates."

Scientists have also found that particularly large dendrites, like the ones Dr. Libbrecht observed, can become the "seeds" or "nuclei" from which big flakes grow.

Mr. Pike's article in *The Journal of Meteorology* mentions the rancher's giant Montana flakes, but finds that report questionable. The rest of his cases tend to be better documented and corroborated, often by meteorologists. For instance, weather officials in Berlin reported a winter storm of January 1915 that produced snowflakes up to four inches wide.

The big flakes, German officials said in *The Meteorologischen Zeitschrift*, "not only fell more rapidly than the small flakes, but also did not swirl about to the same extent." The officials added that "most were shaped like round or oval bowls or dishes with upturned rims. They did rock to and fro in the wind but at no time were they observed to turn over completely so that the concave side would face downward."

Mr. Pike also reports on a winter storm that hit Laramie, Wyo., in September 1970, producing flakes up to three inches wide. A witness watched two relatively small flakes collide and merge to form a large snowflake. Using a stopwatch, the observer also found that the big flakes fell more than twice as fast as smaller ones.

Mr. Pike, generalizing from the reports, concluded that the big flakes tended to form when the temperature was just above freezing, making them wet and sticky. "Ideally," he wrote, "winds should also be relatively light to avoid 'bunches' disintegrating."

The agglomerations seem to start relatively high in the atmosphere, Mr. Pike added. When flakes of modest size form, he said, "there is a fair likelihood that

these will continue to grow by collision and merger, especially at the expense of smaller flakes and crystals falling in their paths at two-thirds or half the speed.”

An airborne expedition near St. John’s, Newfoundland, went further in illuminating the origin of the big flakes. The work began during a fierce storm in February 1992 as scientists of the Canadian Atlantic Storms Program tried to understand the nature of winter gales that lash the coast.

Suddenly, a laser on the side of the plane began to track the presence of snow crystals up to a fifth of an inch wide — about the size of a pea. The team made measurements all over the region and then, back on the ground, found that large snowflakes up to two inches wide were falling and collected samples. After compiling all the weather data and doing extensive computer modeling, the team came up with a detailed explanation.

The drama had begun more than three miles up — unusually high — when large dendrites formed in moist winds that blew slightly upward, keeping the crystals aloft. “That gave them time to grow,” recalled R. Paul Lawson, a team scientist then working at the National Center for Atmospheric Research, in Boulder, Colo. “And it let them fall for a long time.”

Eventually, the big crystals fell through a region of regular snowfall, Dr. Lawson said, bumping into smaller dendrites and needles along the way, gathering them up to form increasingly large clusters.

“As they fell, they tended to accumulate,” he said. “Everything has to come together for it to work.”

The team published its findings, “Observations and Numerical Simulations of the Origin and Development of Very Large Snowflakes,” in the November 1998 issue of *The Journal of the Atmospheric Sciences*. Herbert H. Close Jr., an amateur weather observer in Manchester, Md., knows the magic up close.

One night last winter, amid bolts of blue lightning and peals of thunder, he watched in astonishment as giant flakes began to fall around him. They were so big that the surrounding snow cover turned lumpy.

“It’s a matter of being at the right place at the right time,” Mr. Close said of the unusual show. “Sometimes you get lucky.”

The giant flakes were not quite in the category of sea monsters or U.F.O.'s. Even so, skeptics noted the human fondness for exaggeration, as well as the lack of convincing photographs. And the organizations that compile weather records never made tracking big flakes an observational requirement. So the giants languished in a twilight world of science, their existence claimed but seldom documented. Now, theorists, weather historians and field observers are concluding that most of the reports are true and that unusually large snowflakes two to six inches wide and perhaps wider fall regularly aro