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13 year old researcher finds tree inspired solar collection more efficient

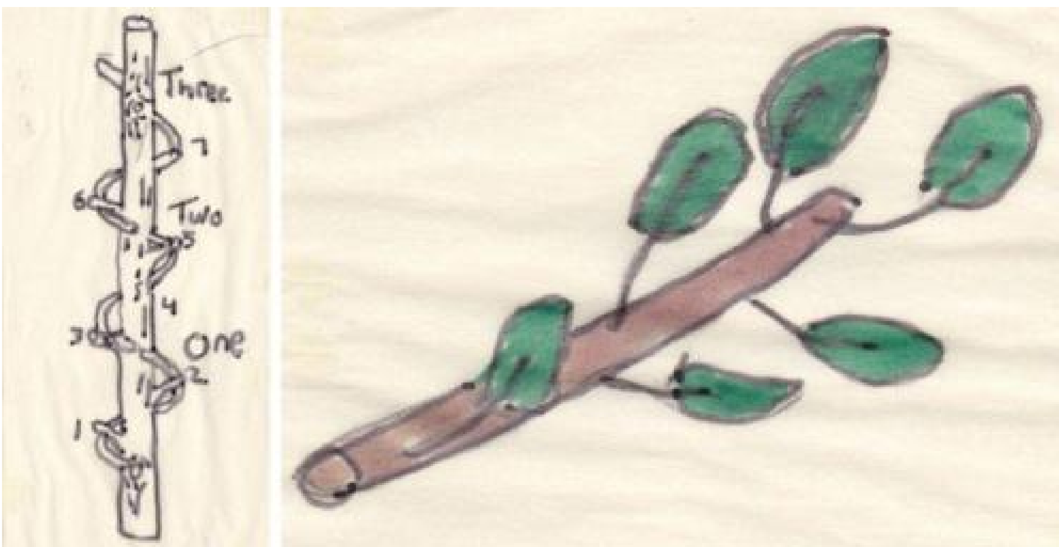
August 22 2011, by Bob Yirka

Aidan measuring the spiral pattern

(PhysOrg.com) -- Aidan Dwyer, a 13 year old Junior High School student from New York state, noticed that the phyllotaxy of the leaves on trees he was observing while hiking through the Catskill Mountains, did so in the form of a Fibonacci sequence. Wondering if there was a reason for it, he deduced that it might be because such an arrangement provides the most efficient means of solar power collection for the trees. To find out if this was the case, he built a small solar tree from PVC pipe and small solar panels, then built another in a normal flat panel array, attached voltage readers to both, and lo and behold, discovered the tree model array was indeed more efficient, at least during times of low or indirect sunlight. Dwyer won a Young Naturist Award for his efforts after writing and submitting his essay, The Secret of the Fibonacci

Sequence in Trees.

The Young Naturist Awards are given (by the American Museum of Natural History) to two students from each grade, K-12, every year for young scientists who have investigated questions they have in the areas of biology, Earth science, ecology, and astronomy. Dwyer's entry, took the known, that tree leaves grow in a Fibonacci sequence (where each number is the sum of the previous two) and applied it in a novel way that advanced the study of solar energy.



The spiral on trees showing the Fibonacci Sequence

With trees, The Fibonacci pattern shows up in the way that limbs spiral around the trunk, specifically in the fraction that arises when computing the number of limbs it takes to complete a run all the way around the tree. Dwyer gives the example of the Oak tree which takes five branches to spiral two times around the trunk, giving the fraction 2/5. This is important because it was the basis of the model he built to replicate the tree structure. Interestingly, to find this fraction, and those of other types of trees, he fashioned his own measuring device out of a clear plastic tube with circle protractors on it. Branch angles were measured by inserting them into the tube.

Next, he built a small model tree (mimicking the Oak's Fibonacci series as closely as possible) out of various sizes of PVC pipe to which he affixed small solar panels. After that, he put together a traditional flat panel solar array comprised of the same size solar panels. Then, after hooking up both to a data logger connected to a voltage meter, he then let them sit.

The two models collecting sunlight

After analyzing his data, he found that the tree design appeared to be far more efficient than the traditional flat-panel structure during so-called off peak times, such as when the sun was low, and that the model appeared to be close to 50% more efficient overall during the winter. Not bad for someone who's still a kid.

Dwyer theorizes that tree branches have evolved such an arrangement because it's likely the most efficient pattern available, i.e. the one that best takes into account the shading created by branches or leaves hiding one another from direct sunlight.

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