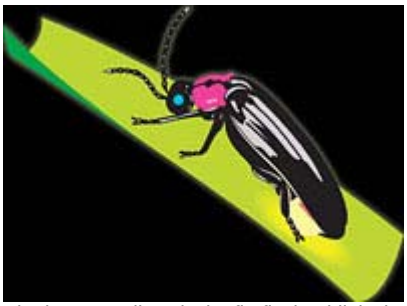
The Night Lights of Elkmont

By Lynn Faust, Andrew Moiseff, and Jonathan Copeland



Photinum carolinus is the firefly that blinks in synchrony in Elkmont.

Magnificent vistas and panoramas draw thousands of visitors to Great Smoky Mountains National Park.

As evening approaches, day hikers and sightseers head off to dinner in Gatlinburg or Townsend or Cades Cove and turn in for the night. Unbeknownst to most, wondrous sights remain to be seen after the crowds leave and darkness again takes over the forest.

Nature exploits the night in many ways. One particularly spectacular way is by plants and animals that can create their own light (called bioluminescence). Fireflies (lightnin' bugs) are obvious denizens of the darkness, and they are common throughout the summer in the Great Smokies.

The flash of the firefly is like a Morse code of courtship.

Both males and females flash at set intervals and in a set pattern. Flying flashing males find stationary females on trees and shrubs or grass and dialog and eventually mate. Mating flash communication is easily seen by the patient observer when it is dark and when what to look for is known.

Each species has its own male-female flash code that is based on the unique timing of male flashes and the unique timing between male flashes and female flashes. Different firefly species can be seen at different locations and at different times during the summer. Because the adults live for only three weeks, Cades Cove might be alive with enormously bright flashes on May 20th and pitch dark, save the full moon, on June 5th.

As twilight falls, discrete flashes of greenish light begin to appear in the darker forested areas. In the Smokies, it may be as late as 9 p.m. before the fireflies begin to fly and flash. Seemingly random, first one male flashes and then another flashes.

Wait, and if the elevation of the land is about 2,000 feet, these seemingly random flashes might fortell a very unique display of flashing that will begin around 9:30 and last until 11:30 p.m..

The random flashes occur at the same time. Is it chance? Maybe, but it repeats too often to be accidental. All of the fireflies in the forest appear to flash at the same time! This is a display of unison flash synchrony by the firefly Photinus carolinus, a firefly whose population epicenter seems to be Elkmont, Tenn.

Photinus carolinus can be identified by the pattern of flashes produced by the flying males. A male produces four to eight very bright flashes in rapid succession (approximately two flashes per second). Then, he waits for eight to 12 seconds and produces four to eight flashes more. The timing is influenced by temperature. Intervals are shorter when it is hotter. A female can be identified because her very weak pulsed flash occurs when the males are not flashing.

When two or more Photinus carolinus are present, they fly close and synchronize their flashes. What is equally remarkable is that in Photinus carolinus, the simultaneity of the flashing is reinforced by the sudden transition to no-flashing. All of a sudden, the forest, just sparkling with light, is dark. And then they are flashing in sych again. Then dark! It mesmerizes! Look closely! It seems like every firefly is flashing together with his neighbors.

Look at the face of any nearby hillside that has Photinus carolinus fireflies flashing on it. Another remarkable sight might be seen: the characteristic four to eight flash burst of Photinus carolinus form bands of flashing fireflies that stretch acrosss the hillside. The bands progress repeatedly, pulsating waves traversing the hillside. This is wave synchrony, the flashing that was known for more than 30 years as the "Light Show" in

Elkmont.

Located where Jake's Creek, Little River, and Bearwallow Creek come together, the community of Elkmont was abdorbed by the GSMNP in 1991 and remains now largely as a deserted collection of once proud homes.

To find the best synchronous flashing, take the road to the left just before the Elkmont Ranger Station, cross an elevated stone bridge and continue down the old country road to the left. Go down the first drive to the right, into an oval field, past the stone wall, and sit down under the trees along the Bearwallow Creek. The Faust cabin is on the right. Look up the steep hillside: wave synchrony will be occurring. Kaleidoscopic pulsations of waves of light, no two patterns exacly like the next, are occurring. On and on they flash, again and again, until almost midnight has come. Turn around! Quite miraculously, the flat area between the driveway and the road is also flashing, but this time it is flashing in unison. What is going on? Look closer: does it seem like one end of the wooded field is lighting up before the next?

The "Light Show" is an odd behavioral display. What seems important to us may not be important to the firefly. What we've discovered through our experimentation is that the "Light Show" occurs because patches of fireflies on the hillside can see each other but, except at the edges, the fireflies within a given patch cannot see the fireflies in adjacent patches.

Within each patch, there is unison synchrony. What happens is that unision synchronies are sequentially activated. So, it looks like a wave when viewed on the diagonal from the base of the hillside. The flashing tends to progress from top to bottom once the "Light Show" matures each evening. We don't know why it usually starts at the top. Maybe it is warmer at the top and, because insects do things faster when it is warmer, the flashing starts at the top. Because the fireflies are flying as they flash, the patterning of the "Light Show" is ever changing.

The "Light Show" goes on from about June 5-20, though its seasonality varies from year to year. To see it, dress for the weather (sometimes cold and rainy) and bring along a flashlight covered with blue/red celophane (the fireflies are bothered by an uncovered flashlight's white light and can't see red light well and blue light not at all). It's probably important to stay on the roads and paths and heavly travelled areas, because there are snakes and holes and abandoned wells all through Elkmont.

The magnificent "Light Show" makes Elkmont a very special place in the Southeast, if not North America.

Go further up the hill to the main part of the former Elkmont community. Suddenly the realization becomes conscious thought: the pulsating visual concert of the fireflies that has been part of our entire night walk is diminishing both in synchrony and density. By the time the Kuhlman's cabin is reached at the top of the hill, less than half a mile from the Faust's cabin, the magnificent "Light Show" is non-existent. Thus, Photinus carolinus fireflies are evident, but there are not enough to trigger mass synchrony.

The Kuhlman's cabin, the last on the hill, is the last cabin in Elkmont. Stand where this peaceful, empty old cabin now stands. Look beyond. The encroaching forest quietly re-establishes its eternal rule. It is miles and miles until morning. Here, even as you stand and gaze into the forest, other species of fireflies and unseen creatures of the night hold dominion.

Remember, you will pass with inches of these described marvels and never see one thing if you keep your flashlight on.

(Trained as an anthropologist, Knoxvillian Lynn Faust is a wife, mother, and naturalist. Andrew Moiseff is an associate professor of physiology and neurobiology at University of Connecticut. Jonathan Copeland is a professor of biology at Georgia Southern University.)

Sychrony in Elkmont: A Story of Discovery

By Jonathan Copeland

Post-doctoral fellow Fabiana Kubke of the University of Maryland looks on as Jonathan Copeland and Andy Moiseff, seated, are at work.

Andy Moiseff and I got a grant to study synchrony in Southeast Asian fireflies.

Andy's allergic to about everything, including the ability to eat Asian food. So, I had to do the fieldwork.

In the summer of 1992, I went to Singapore, Maylaysia and Indonesia looking for and studying synchrony in these congregational fireflies.

Finding the animals is rough going when all you speak is English. People will tell you "yes, they're there" and so on, and you'll go trooping out to some river and watch the trees until 2 a.m. and either no synchronizers are present or the fireflies that are present are rover fireflies, flashing by themselves.

In the U.S., I'd get calls of people claiming to have seen synchronous flashing in fireflies. I was always skeptical, because the scientific literature on synchrony in fireflies says that North American fireflies don't really show synchrony. Usually, when I'd get to the field, there would be butterflies flying in sunlight. In other cases, fireflies would be present, but they simply weren't synchronous.

In yet other cases, the fireflies would drift into and out of synchrony over a short period of time.

In October, 1992, I was fresh from Southeast Asia when I received an odd telephone call from Lynn Faust which changed the way we think of synchrony today. Lynn introduced herself as a housewife and summer resident of Elkmont. She said that she had read a story about my firefly work in Southeast Asia and she wondered if I was interested in looking at the fireflies that were flashing around the Elkmont cabin her family had rented for 30 to 40 years.

She said that one of her fondest memories over the past 20 years was the extended Faust family gathered in the screened in porch that looked over the creek, and in June, in total darkness, the hillside about the creek would come alive with light and the fireflies were flashing synchronous. She called it "the Light Show."

I listened with considerable interest and wondered "Could it be? Nah. It couldn't."

After all, I thought, scientists had been looking for synchrony in North American fireflies for years. If the professionals couldn't find it, then it simply wasn't there.

On the other hand, the grand old man of firefly work, John Buck, now retired from the National Institute of Health in Bethesda, Md., once told me that he was intrigued by letters he got about synchronous flashing from people living in the Southeast. He and his wife took a trip one summer through the coastal states to investigate, but nothing had turned up. He speculated that because the firefly adults live only three weeks as adults and flash only at night, and the synchrony might be population dependent, it made sense that folks traveling on a country road at night might be the people to discover synchrony in fireflies in the U.S.

Faust knew the fireflies were spectacular, but she didn't know they were scientifically interesting. She was informed and she called. What to do?

I asked Faust to write a musical score of what she saw, entering each individual firefly on an separate staff

line and letting the elapsed time read from left to right. I asked her to indicate from memory the flash behavior of five to 10 fireflies. When I got her letter, it sure looked like synchrony to me. Moiseff and I decided to investigate in June of 1993.

At the deserted Faust cabin, it was foggy, cold and rainy. It got dusky and nothing happened. Then, it got dark and nothing happened. I was sitting in my car, feeling a little sleepy.

I opened my eyes at the right time, because in the woods between the Faust cabin and the road, the fireflies were flashing synchronously! They flashed about six times and then the woods were completely dark. And then, they began again. It was one of the wonderful moments of discovery that come every now and then to a scientist.

It was clear to me the fireflies were there and they were synchronous. The only thing left was the hard part. We had to prove it.

If there is a punch line to this story, it is this: all you need is a little time and informed and open mind.

You don’t need to be a scientist to make discoveries. All you need to do is be there, out in nature, walking and watching and observing and noting what for you is unusual.