

Luminous Arcs Discovered Between Galaxies

While surveying clusters of galaxies for other purposes, Roger Lynds of Kitt Peak National Observatory at the National Optical Astronomy Observatories in Tucson, Ariz., found two, possibly three examples of bright luminous arcs stretching between galaxies in three of the 58 clusters of galaxies he surveyed. The discovery of such intergalactic arcs is unprecedented. They were unknown before now, and what they are made of and how they got where they are remain mysteries, Lynds and theorist Vahe Petrosian of Stanford University told last week's meeting of the American Astronomical Society in Pasadena, Calif.

were stars blown out by a blast wave, they should form fragments of spherical shells, and they don't seem to. They seem like pieces of rope — or, as one scientist put it, sausages. Furthermore, such an explosion would require the energy of 100 million supernova explosions — the thermonuclear explosions of 100 million large stars — to drive it. Such an explosion should leave other evidence behind, and there is none of that.

If the arcs were dragged out of the galaxies in their clusters by some kind of tidal distortion by a mass in the center of each cluster, there would have to be a mass there equal to 100 trillion (10^{14}) suns, something many times larger than most galaxies. Moreover, the shape of the arcs is too smooth for them to have been made that way.

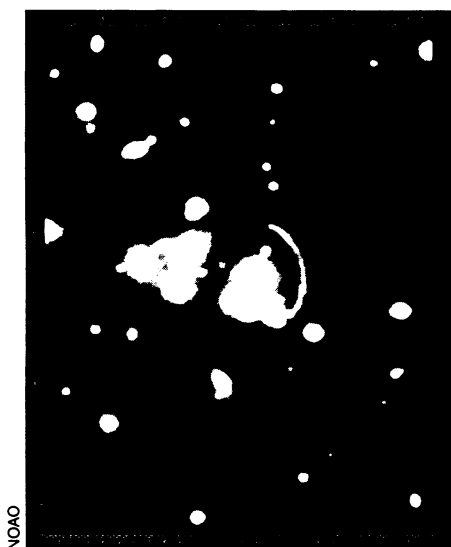
If the arcs were made of nonstellar matter — that is, if they were giant examples of the jets associated with quasars and some galaxies — they would have to be

strong radio emitters. One attempt to find radio waves from them came up negative, but that is not conclusive. However, such jets radiate by mechanisms that involve large amounts of highly energetic electrons. To energize jets of this size in that way, Petrosian estimates, would take the energy of a billion supernovas. The source of such energy should be obvious, and it isn't.

A fourth, less prominent possibility is that they are something primordial, left over from the time the galaxies formed. But there is not yet much theory about that one way or the other.

Future plans include looking for more examples of these jets, and trying to get their spectra. Lynds also says he would like to use the Very Large Array of radiotelescopes near Socorro, N.M., to see whether they show up as radio emitters. Future activity will also undoubtedly include some more theorizing.

— D.E.Thomsen



NOAO Galaxy cluster 2242-02 with large arc.

The arcs are more than 100,000 parsecs (300,000 light-years) long, blue in color, sharply defined and shaped in almost perfect circular arcs. They are very luminous, with powers equal to 100 billion suns, but they are also very far from us.

The geometric perfection is especially intriguing, Lynds and Petrosian say, as nature rarely deals in such perfect shapes. "It's as if God took a piece of rope and bent it there," Petrosian says.

The blueness may indicate that the arcs are made of young stars. Young stars are blue; mature stars tend to be yellow or white. Spectra will tell whether there are stars in the arcs, or whether they are simply made of some luminous gas. So far the observers have not been able to obtain spectra, but that is one of their aims for the future.

Whether the arcs are made of stars or of other matter taken out of the galaxies or from the intergalactic space of the cluster, how they got where they are is another puzzle. Petrosian says the three most obvious possibilities don't work. If they

Cameroon lake: New clues, new clouds?

Just as final reports are being issued on the disaster that killed 1,746 people last August when an asphyxiating carbon dioxide cloud exploded from Lake Nyos in Cameroon (SN: 9/20/86, p.180), the lake may have been racked by three new explosions. On Dec. 30, according to the Associated Press, a French scientist reportedly observed the explosions, accompanied by light flashes, in the space of five minutes. No injuries or fatalities were reported.

However, according to Paul Krumpe at the U.S. Agency for International Development (AID) in Washington, D.C., that report does not completely jibe with information presented to the U.S. ambassador in Cameroon. "We're not sure exactly what has transpired, if anything," he told SCIENCE NEWS. "We've asked the embassy whether they'd like some technical assistance to evaluate what may or may not have happened."

While scientists who have studied the lake are puzzled by the reports of light flashes, they say the explosions, if confirmed, would be consistent with theories proposed to explain the August event. Studies have shown that the highly stratified lake contains high levels of dissolved carbon dioxide. Many scientists believe that something upset the stratification, causing a runaway degassing of the lake and the explosive eruption of the carbon dioxide cloud.

The Dec. 30 explosions may be "larger than what we would have predicted for this soon after the main August event,"

says volcanologist John Lockwood. But "we're loath to make any statement because we don't know what went on." Lockwood, at the Hawaiian Volcano Observatory on the island of Hawaii, was a member of the team sent to Cameroon by AID.

That team's final report on the August event is scheduled for release this week. Most noteworthy, according to scientists familiar with the report, is the team's resolution of the sulfide mystery: Scientists had speculated that hydrogen sulfide or other sulfur compounds were in the cloud because witnesses reported smelling rotten eggs or gunpowder, both of which have distinctive sulfur odors. Investigators also thought at first that the victims had been burned by sulfuric acid or other chemicals. However, geologists could find no measurable levels of sulfides in the lake.

Members of the medical team say they now believe the victims' skin lesions, probably similar to bedsores, developed because the people had been lying unconscious for many hours. And, they say, the thermal burns they observed came not from hot gases emitted from the lake, as some had speculated, but because some of the victims had become unconscious next to heat sources such as stoves.

Moreover, the AID researchers found past studies in which a large percentage of volunteers subjected to low levels of carbon dioxide had "olfactory hallucinations" in which they smelled sulfide

odors when none were present. The subjects also felt warm, another sensation reported by Cameroon survivors. Happily for the survivors, the AID report notes that no long-term health effects from exposure to the cloud have been found.

As for the geologic analyses, Lockwood and others say they have added many more data to their initial findings, but have not changed the basic conclusions. They believe the lake's carbon dioxide gas has a volcanic origin and had built up slowly in the lake over a long period of time. They still don't know what triggered the explosion, but they don't think a sudden volcanic eruption or an earthquake was responsible.

Without speculating on the cloud's triggering event, two British scientists have arrived at essentially the same conclusion. In the "News and Views" section of the Jan. 8 NATURE, S.J. Freeth of the University College of Swansea and R.L.F. Kay of the British Geological Survey in Wallingford estimate that about 200,000 metric tons of water and about 6,000 metric tons of gas were lost from the lake.

One volcanologist who has held somewhat different views about the cause of the Lake Nyos cloud is Haroun Tazieff, recently retired from the Center for Weak Radioactivity Research in Gif sur Yvette, France. According to Associated Press reports, Tazieff and his colleagues think the cloud was made up of steam, carbon dioxide and sulfur compounds that had been building up in a layer of groundwater heated by volcanic rocks far below the lake. These compounds reportedly were injected into the lake when the pressure of the steam eventually cracked the rock that had been holding it down.

Some U.S. scientists have argued against this theory by noting that lake temperatures were not elevated, its bottom did not appear to have been disturbed, there were no volcanic sulfides in the lake and no suspended sediments that might have resulted had steam rushed through bottom sediments. However, Lockwood says he and other U.S. scientists are reserving judgment because they have not yet seen Tazieff and his colleagues' evidence. Scientists from all the nations involved in studying Lake Nyos may be able to compare their data in February or March at a proposed meeting in Cameroon, according to Krumpke.

The critical question now, says Lockwood, is how dangerous the lake will be in the future. And one key to that hazard assessment is knowing how fast carbon dioxide is being added to the lake. The AID report assumes "that the injection is gradual," he says. "Tazieff would say that there was perhaps a more rapid influx of gas that triggered the event. But no one has evidence that bears on the rate of injection. So what's desperately required are more frequent measurements of the amount of gas dissolved in that lake."

— S. Weisburd

The fragile, creative side of nightmares

What kind of person has lifelong nightmares? In 1931, psychoanalyst Ernest Jones suggested that the repeated intrusion of these fearful dreams into sleep is related to an "anxiety neurosis" and massively repressed incestual wishes.

But recent investigations of lifelong nightmare sufferers, including one study reported in the January ARCHIVES OF GENERAL PSYCHIATRY, describe a personality profile marked by emotional vulnerability, sensitivity, creativity and often some schizophrenic-like oddities of thought and behavior. "It appears that the ordinary fears, feelings of helplessness and rage of childhood, which we probably all experience, 'get through' in these persons and enter into their dreams more than they do in most of us," say psychiatrist Ernest Hartmann of Tufts University School of Medicine in Boston and his colleagues.

The investigators studied 12 lifelong nightmare sufferers, 12 vivid dreamers who had no nightmares and 12 persons who had neither nightmares nor vivid dreams. Each group contained six men and six women aged 20 to 35 years.

The group with nightmares had much higher scores on several scales of the Minnesota Multiphasic Personality Inventory (an extensive self-report questionnaire) than the other two groups; the elevated scores indicated distrust and oversensitivity to others, feelings of being different, poor self-esteem and alienation from feelings. Nightmare sufferers also had more creative and complex responses to Rorschach inkblots, often including themes of anxiety, violence, paranoia and an unclear "personality boundary." An example of this last theme was describing an inkblot as "two women merging into each other."

But only one nightmare sufferer was clearly schizophrenic, say the researchers, and half of the nightmare group had no psychiatric diagnosis. Interviews and further projective tests uncovered no evidence of depression, an unusual number of fears, powerful hostilities, repressed sexual wishes or childhood trauma.

Compared with the other two groups, nightmare sufferers were more often unemployed or inconsistently employed. Those who were employed had occupations related to the arts and, according to Hartmann, often reported making use of their nightmares in their creative work. Marriages, sexual relationships and friendships of the nightmare sufferers were considerably more tumultuous than those of the control groups.

The results confirm prior observations of 38 long-term nightmare sufferers (SN: 5/24/80, p.335), says Hartmann. Similar but less severe personality patterns have been independently noted among people

with less frequent nightmares.

In contrast, war veterans experiencing frequent nightmares as part of a post-traumatic stress disorder have not been found to have the openness, vulnerability or schizophrenic-like problems observed among lifelong nightmare sufferers. People with night terrors, which are sudden arousals early in the night associated with fear and screaming, but with either no dream content or a single frightening image, also do not display the personality profile of the lifelong nightmare group, notes Hartmann.

The relationship of lifelong nightmares to schizophrenia and artistic creativity remains unclear, but Hartmann says the emotional vulnerability of nightmare sufferers may make them more vulnerable to mental disorders.

— B. Bower

Gene transfer in corn

Recent genetic engineering experiments with maize, or Indian corn, mark the first time a member of the grass family has been infected by a virus carried by the bacterium *Agrobacterium*. The procedure, called agroinfection, is the increasingly common laboratory technique used to transfer selected DNA into plants by adding that DNA to the DNA of *Agrobacterium*, then allowing the bacterium to "colonize" plants — which it does by transferring part of its DNA (including the foreign, "third party" DNA) into the host plant's own genetic material.

The success with viral DNA — which was used because, among other things, its effects are easily detectable — demonstrates for the first time that agroinfection is an efficient way to induce foreign DNA expression in corn cells. Moreover, the results, described in the Jan. 8 NATURE, extend the possibilities of using beneficial DNA — such as those that code for resistance to viruses — to genetically improve a plant family that includes all the cereal grains, sugarcane and many sources of animal feed.

Researchers at Friedrich Miescher Institute in Basel, Switzerland, and John Innes Institute in Norwich, England, used this method to infect plants with maize streak virus DNA. Characteristic symptoms of the disease appeared seven to 18 days after they inoculated seedlings with viral-DNA-bearing *Agrobacterium*. Normally, plants develop the disease only if the virus is intact and transmitted by an insect.

Scientists had generally thought that members of the grass family were not amenable to agroinfection, which is considered an efficient way to induce foreign DNA expression in whole plants.

— D.D. Edwards