scopes at Kitt Peak near Tucson and the Lick Observatory atop Mount Hamilton in California. They presented their findings this week in Tucson at an American Astronomical Society meeting and have detailed their work in the Jan. 1 ASTROPHYSICAL JOURNAL LETTERS.

The galaxy lies an estimated 12 to 15 billion light-years from the Milky Way. (The distance depends on the much-debated value of the Hubble constant, a number that provides a measure of both the universe's rate of expansion and its age.) Telescopes are like time machines: As they look deeper into space, they look further back in time. Thus, the distant galaxy looks as it did when the cosmos was just one-tenth its current age.

Yet Dey notes that the northern half of the galaxy is extremely red, indicating that it has already undergone substantial aging. The red color has two possible explanations — that old stars are present in the youthful galaxy or that the object is cloaked in dust. The existence of dust implies that a previous generation of stars in the galaxy has already lived and died. Massive stars expel dust as they eject their outer shells in supernova explosions.

Spinrad notes that the galaxy spans 200,000 light-years in diameter, making it about five times the size of Andromeda, the Milky Way's nearest spiral neighbor. Using a model to determine what kind of galaxy in the nearby universe 8C 1435+63 might resemble as it ages, the team speculates that it shares a common heritage with giant elliptical galaxies. The galaxy's irregular shape suggests it may be in the process of merging with another body. *— R. Cowen*

HIV toll: Over a billion white cells a day

This week, a pair of independent research teams describes the intense battle that erupts when HIV, the AIDS virus, gets a foothold in the body. Using biochemical and genetic techniques, both groups tracked the rise and fall of HIV and of CD4 T lymphocytes, the white cells targeted by the virus. Their results confirm that HIV eventually overwhelms the immune system.

The new analyses document the "titanic struggle" between HIV and the body's immune system, comments Simon Wain-Hobson of the Pasteur Institute in Paris. Wain-Hobson's editorial and the teams' reports appear in the Jan. 12 NATURE. The work provides "the precise quantitative and mathematical confirmation of a phenomenon that was strongly suspected . . . but never nailed down," adds Anthony S. Fauci, director of the National Institute of Allergy and Infectious Diseases in Bethesda, Md.

Last year, scientists began to realize that HIV is not inactive during the time between infection and the appearance of AIDS. Instead, the virus gradually accumulates in the lymphoid organs (SN: 3/27/93, p.196).

The new studies indicate that HIV replicates like mad. "We believe it is the engine that drives the . . . disease," says David D. Ho of the New York University School of Medicine in New York City. At the same time, CD4 T cells are multiplying at terrific rates, he notes. The result is a relentless race between the infecting virus and the immune system, one eventually won by HIV.

For this work, Ho's team administered the antiviral drug ABT-538 to 20 people, most of whom had advanced HIV infection. Throughout the study, the researchers monitored the concentrations of virus and CD4 T cells in the volunteers' blood. Meanwhile, George M. Shaw of the University of Alabama at Birmingham and his colleagues treated 22 HIV-infected people with ABT-538 or other antiviral drugs. Shaw's team also began tracking virus and white cells.

Before treatment, virus destroyed by the immune system was replaced with new virus on an ongoing basis. To keep up its offensive against HIV, the body gets rid of about a billion virus particles per day. With treatment, the amount of virus halved approximately every 2 days for the first few weeks, both groups note.

These drugs also cause a sharp boost in the production of CD4 T cells, the two teams report. They calculate that without treatment, the body loses — and must make — more than a billion of these white cells daily.

The dark side of HIV treatment began to surface after drug therapy, however, when Shaw's group found that the dramatic drop in HIV didn't last. Within 2 to 4 weeks, virus that resisted the drug blast replicated, producing a more dangerous, drug-resistant HIV infection.

— E. Pennisi and K.A. Fackelmann

Chaotic chaos in linked electrical circuits

Little could be more disconcerting and frustrating to a scientist than discovering that supposedly identical experiments somehow produce radically different results. Such perplexing, discrepant data would typically end up in a wastebasket rather than a journal.

But the mathematical — and now physical — evidence that such a situation can actually occur is mounting. Mathematicians have pinpointed how certain features in equations, including some of those used to describe physical phenomena such as fluid flow, lead to an extreme kind of unpredictability in the solutions to those equations. Physicists have demonstrated similarly erratic behavior in sets of linked electrical circuits.

"You have a deterministic system, yet you lose experimental replicability," says James C. Alexander of the University of Maryland at College Park. "You're always going to have little errors, and such small changes in initial conditions may lead to completely different long-term behavior."

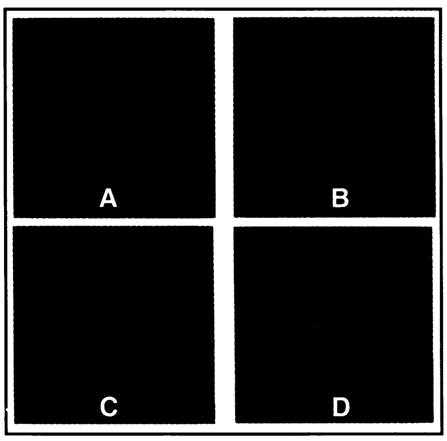
Alexander described these developments at a Mathematical Association of America meeting held last week in San Francisco.

A wide range of physical systems shows the sensitive dependence on initial conditions that characterizes chaotic behavior. For example, in certain electronic circuits, small changes in the initial voltage can alter the pattern of voltage fluctuations that occur at later times in the circuit.

Nonetheless, a chaotic system's long-term, average behavior remains qualitatively predictable. A particular set of initial values leads to a certain type of outcome, even though one can't predict the details of that behavior.

Equations representing such systems can also have multiple solutions, or attractors, which correspond to different types of behavior. In some cases, a certain set of starting values may lead to one attractor, whereas other values lead to a completely different attractor.

In 1992, Alexander and his colleagues found a theoretical example in which the



Ashwin et al.

Increasing the value of a particular parameter (from top left to bottom right) alters the basin of attraction (A, black area) corresponding to one type of behavior. The basin becomes riddled (B and C), then virtually disappears (D).