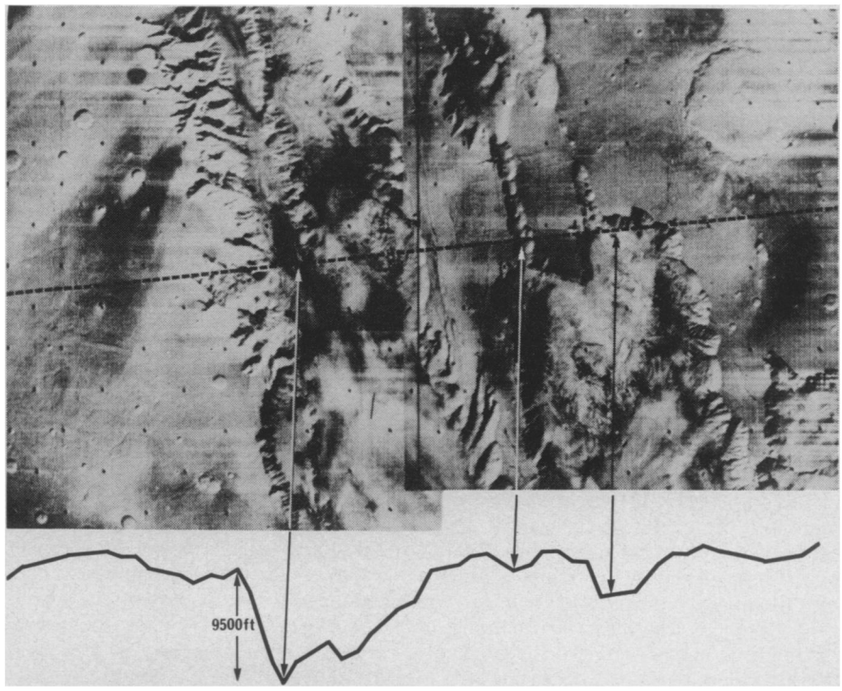
A huge Martian canyon

This week Mariner 9, while on its 216th orbit of Mars, completed its primary mission objective—mapping more than 70 percent of the planet's surface. More than 6,500 photographs have been taken.

A mosaic of two of these photos reveals vast chasms and branching canyons in the Tithonius Lacus region that present a landform evolution unique to Mars—an equatorial canyon twice as deep and six times as wide as the Grand Canyon. Measurements from the ultraviolet spectrometer show the canyon, which is 75 miles across, to be 9,500 feet deep, compared with the Grand Canyon's 5,500-foot-depth and 13-mile breadth. The feature is part of a complex of canyons and ravines that extend for 2,500 miles across the Martian surface. The closest similarity on earth is the great rift valleys of Africa that run the length of the continent.



with a similar antenna being built at Rochester by David H. Douglass.

Meanwhile other experimental groups, several in the United States, in Great Britain, in Italy, possibly in Japan and Canada, are preparing equipment expected to operate in the next year or two. To prepare the minds of specialists for the results that may come and their implications, the Royal Astronomical Society of Great Britain held a one-day discussion on Jan. 14.

As might have been expected two general schools of thought emerged. Martin Rees of Cambridge University exemplified one in his statement that the validity of both Weber's results and the theory of general relativity (which governs gravity and the production of gravitational radiation) could not be accepted. Dennis Sciama of Oxford takes the other side in maintaining a hope that reconciliation may be possible.

Attempts at reconciliation tend to depend either on scrapping the assumption that the source radiates isotropically (the same in all directions) or on arriving at new formulations in general relativity that will do away with the need to destroy so much mass to get the observed radiation.

A way to get more directional radiation is to suppose that there is a rotating black hole of about 10 million or 100 million solar masses in the center of the galaxy. The black hole was first suggested by Donald Lynden-Bell and James Bardeen. Charles Misner of the University of Maryland has developed a model in which such a thing radiates linearly polarized gravitational synchrotron radiation highly concentrated in its equatorial plane. The equatorial plane of such an object would coincide more or less with the plane of the galaxy, and because the solar system also lies more or less in the plane of the galaxy, it is probable that Weber's detectors would pick up the beam.

Misner's model has been subject to some criticism in detail. Some have faulted the mechanism by which he gets the synchrotron radiation. Tyson and Douglass have done calculations that show that Weber's results do not appear to correspond to linearly polarized radiation from such a source.

The anisotropy, the concentration of the radiation into a plane, depends on the linear polarization. Tyson and Misner are engaged in a discussion of how much depolarization can be allowed so that the predicted radiation matches Weber's results and yet maintains enough anisotropy to avoid the unacceptable mass loss.

Another theoretical approach involves finding detailed solutions of the equations of general relativity for situations where the gravitational field is strong. Most of the solutions of the theory that have been done in the past have been for weak-field cases. They are somewhat easier to do, and they have been the major interest of cosmologists because large-scale gravitational fields in the universe are weak. But where gravitational waves of the observed strength are produced, fields have to be strong; since the theory is highly nonlinear, the strong-field solutions cannot be simple extrapolations of the weak-field ones.

The strong-field solutions may show that the assumed rate of conversion of mass to radiation is wrong. They may show that space-time singularities are possible. These would be circumscribed locations where the ordinary laws of physics do not apply and bizarre things can happen. Or the solutions may show that the theory needs adjustment.

Weber may be wrong. Einstein may be wrong. Something else may be wrong. Or everything may somehow be compatible. Sciama points out that it was nearly fifty years after the discovery of superconductivity that theorists managed to reconcile it with the laws of physics. Gravity-wave specialists hope this case will not take that long. □

Abortion law upheld

The constitutionality of New York's liberal abortion law (SN: 1/29/72, p. 75) was affirmed last week by a Brooklyn Appellate Court. The suit would have halted abortions in the state's municipal hospitals and would have set a precedent for similar court actions throughout the country. The four-to-one decision was based partially on the fact that an unborn child is not a legal person. Robert M. Byrn had been appointed special guardian of all unborn fetuses by the New York State Supreme Court. He initiated the suit and now intends to appeal immediately to the State Court of Appeals. If his demands are not met there, his case, like many others, will probably eventually go to the United States Supreme Court.