

earth.

Leading observatories throughout the country have announced their plans for astronomical observations during the time of this visit of Mars close to the earth.

EXTENSIVE PROGRAM PLANNED AT LOWELL OBSERVATORY

Flagstaff, Ariz.- At the Lowell Observatory, which has followed closely and observed carefully every opposition of Mars since 1894, a program of observations has been under way for some weeks, according to Dr. E. C. Slipher, director. The methods of observations used at this observatory at past approaches of the planet will be continued with added refinements, while newer methods of observation and instrumental equipment are to be employed in new fields of investigation.

"The size and density of Mars, its position and motion with regard to the sun and the length and character of its seasons as well as the length of its day have long been known with satisfactory accuracy," Dr. Slipher said. "Now the chief objects of observation are to determine the physical conditions existing on the planet. The aim is to learn more of the extent, density, and constitution of the atmosphere; the constitution of the polar caps; the determination of the planet's surface temperature; a further knowledge of seasonal changes and the nature and cause of the change in the dark markings or 'canals'.

"It is planned here to make visual observations with the 24-inch refractor telescope depicting the markings, polar caps and other features in drawings supplemented by notes and measures with the micrometer. These are intended to detect changes and trace out their cause. In particular the visual study will include observations and measures of well known markings to determine their position in Martian latitude and longitude. Measurements of salient points on the disk will also serve to check the adopted position of the axis about which Mars turns every 24 hours and 37 minutes.

"Large scale telescopic photographs of the planet will be taken at the same time to supplement the visual work. The photograph is more efficient in the exact rendering of tone and intensity of markings and their relative positions, and gives trustworthy confirmation to visual observations. The photographic record of the planet secured here, now extending back twenty years, is of great value in the study of this planet. Moreover, extended and systematic photographic record of the planet will provide comparable and incontestable material for future study of Martian changes and their interpretation.

"Photometry of the planet's surface will be carried out in order to measure the relative brightness of different parts of the surface and the character of the variations of the brightness of the markings.

"Large scale photographs will also be made with the 40-inch reflector, employing color sensitive plates exposed through different colored filters so as to measure the color values of the different markings. These should give valuable information on the nature of the markings and the changes taking place there. Observations of the spectrum of the planet will be carried out.

"In order to further the knowledge of the surface temperature on Mars, a

radiometer or sensitive heat measuring instrument will be used on the 40-inch reflecting telescope to measure the heat energy emitted by the surface of the planet.

"While it is true that Mars will shine forth from our southern sky this summer the biggest and brightest he ever appears to dwellers on the earth, yet I fear most persons greatly over estimate the scientific value of this once-in-two-hundred year view of him. Since we cannot see forthright in the telescope the exact nature of what exists on any of our planets, but arrive at these facts by more or less indirect means, the value of observations is not entirely dependent upon or commensurate with nearness of view. For this reason, observations made at the exact time of nearest approach of the planet do not have an important advantage over those made on many nights before or after that date. Because we can not watch the progressive development of the markings throughout any single Martian year, our knowledge of him must be gained chiefly by correlating and piecing in the observations of different seasons of different years. For these reasons a few observations of the planet when nearest the earth are not likely to add much if anything to the exact knowledge of it, unless some highly informative phenomenon should obligingly chance to appear during that brief study."

SATELLITES OF MARS TO BE STUDIED BY NAVAL OBSERVATORY

Washington, - The two satellites or moons of Mars will occupy the attention of astronomers of the U. S. Naval Observatory, at the time of the favorable opposition of Mars in August, Capt. Edwin T. Pollock, U.S.N., superintendent of the observatory, has announced.

Phobos and Deimos, the two satellites, were discovered at this observatory by Dr. Asaph Hall, sr., in 1877.

"They are small and faint objects, the inner, Phobos, perhaps 36 miles, and the outer, Deimos, perhaps 10 miles in diameter," Capt. Pollock explained. "When they are at elongation, that is farthest away, apparently, from the planet, these moons can be seen with moderate sized telescopes by putting Mars out of the field. The Greenwich times of elongation can be taken from the American Ephemeris.

"The observations of the moons furnish among other data the mass of the planet. The inner satellite, Phobos, is only 3680 miles from the surface of Mars. It can not be seen from the regions about the planet's poles.

"From the equator of Mars Phobos, in the zenith, might appear as large as the Earth's moon.

"On account of its short period of revolution Phobos rises in the west, passes eastward across the sky, and sets in the east, making more than 3 revolutions while Mars is turning once on its axis. The short period of Phobos raises curious questions as to the theory of the development of the solar system.

"The period of Phobos from meridian to meridian is 11 hours, that of the outer moon, 14,000 miles from Mars, Deimos, is 131 hours. This is more than four of the months of Deimos, which therefore goes through all its changes of phase four times during this interval."