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Eli Maor: June 8, 2004--Venus in Transit

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Prologue

JERUSALEM, Tuesday, June 8, 2004. The sun has just risen over the barren hills of the Judean Desert to the east, where, on a clear day, one can see the Dead Sea and the Moab Mountains beyond. From atop a tall minaret in the Moslem Quarter of the walled Old City, the *muezzin's* monotonous, melancholic chant is already calling the faithful for their morning prayer. In the adjacent Christian Quarter, a lonely church bell chimes in the distance. And in the Jewish Quarter, pious Jews in their black garb solemnly walk down a narrow alley leading to the Western Wall, the sole remnant of King Herod's mighty Temple, where they will pray in devotion, as Jews have done every day for the past two thousand years. In another hour or two, throngs of shoppers and tourists will fill the Old City's narrow alleys, lined up with countless bazaars, small coffeehouses, crafts stores, and souvenir shops. The air will be saturated with the inviting fragrance of spices, the smell of produce and meat, and the aroma of freshly baked bread and *pita*. Another hot summer day in this 3,000-year-old city is about to begin.

But for several hundred people, gathered on the high ridge of Mount Scopus overlooking the city from the east, this will be anything but just another day. Below them to the west, a breathtaking panorama of the city has just unfolded,

dominated by the golden Dome of the Rock glittering in the first rays of sunlight. From this very ridge, the Roman legions under Titus's command lay siege to Jerusalem in A.D. 68, to be followed by the Crusaders, the Mamluks, the Turks, the British, the Jordanians, and the Israelis. From this ridge, countless pilgrims followed Jesus' last journey down the Via Dolorosa into the walled city; it was here, one mile to the south, that Jesus was tried and imprisoned. Kings and statesmen stood in awe at this very place, taking in the sights and sounds surrounding them. Kaiser Wilhelm II of Germany came here on a royal visit in 1898; Winston Churchill, then the British colonial secretary, followed in 1921, and Albert Einstein gave here his inaugural address at the ceremonies opening the Hebrew University of Jerusalem in 1923, his first and only speech in Hebrew.

But the group of people gathered here today are directing their gaze not westward but to the rising sun in the east; their thoughts, at least for now, are not about the 3,000 years of history surrounding them, but on the immediate future before them. They came here from all over the world to witness a once-in-a-lifetime heavenly spectacle. Their cameras and telescopes, carefully covered with protective filters, are already aimed at the rising sun. Last-minute adjustments are made in a hurry, the equipment is checked and rechecked for any possible glitches, and everyone is anxiously listening to the latest weather forecast, hoping and praying that an unexpected cloud will not block the sun at the last minute. But so far the sky has been clear, as it usually is at this time of the year.

As the minutes tick by, a sense of expectation settles over the group. Time passes: it is 7:30 in the morning, then 8:00. Now the tension is almost unbearable. In just a few minutes

these people, like many others at locations as far away as China and Australia, will witness a sight seen by humans only five times before. At precisely 8:19 A.M., a tiny notch, barely visible at first, is seen entering the eastern edge of the solar disk. A loud shout spontaneously erupts from everyone's throat: *first contact!* In the next few minutes the notch slowly encroaches on the sun's face, and the shape of a small black circle clearly makes itself apparent. The spectators are glued to their instruments. Clocks tick, cameras click, and in a few more minutes the black circle will be totally immersed in the sun's disk: *second contact*. It is 8:38 A.M.

The tension now eases a bit, and people excitedly exchange impressions of what they have just witnessed. For the next five and a half hours the black dot—the silhouette of planet Venus projected against the sun—will slowly move across the solar disk from east to west. At 2:04 P.M. third contact occurs, to be followed nineteen minutes later by fourth contact—the instant when the image of Venus finally leaves the sun, not to return until the year 2012.

The passage of Venus in front of the sun is among the rarest of astronomical events, rarer even than the return of Halley's comet every seventy-six years. Only five *transits of Venus*, as the phenomenon is technically called, are known to have been observed by humans before: in 1639, 1761, 1769, 1874, and 1882. But should anyone miss the transit of 2004, all is not lost: the next transit will occur on June 6, 2012, although it will be visible in its entirety only from the Pacific Ocean and the extreme east coasts of Siberia, Japan, and Australia. Then it will be a long wait once again, until December 11, 2117, when Venus will again pass in front of the sun—a bit too far in the future for most of us.

Admittedly, the heavens can offer sights more spectacular than a transit. Nothing can match the grandeur of a total solar eclipse, when for a few precious minutes—and sometimes only seconds—the solar disk is completely covered by the moon, and the pearly corona—the sun’s tenuous atmosphere—can be seen glowing around the moon’s dark image. But what makes a transit so unique, besides its extreme rarity, is its potential use in determining the value of the *astronomical unit*—the mean distance between the earth and the sun. This distance, about 93 million miles, is known today with great precision, but in the eighteenth century its determination was one of the most daunting challenges facing astronomers, who devised numerous schemes to meet it. To follow the story of these attempts, we must go back to the seventeenth century, when the possibility that Venus may on rare occasions pass in front of the sun was first given serious thought.