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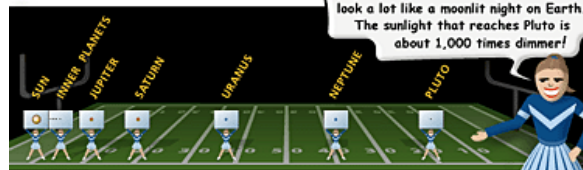**Solar System Scale**   **07.09.04**

Image above: The inner planets are all within the 3 yard line and Pluto is on the other end of the field on the 20 yard line. Credit: NASA

Our solar system is huge. There is a lot of empty space out there between the planets. Voyager 1, the most distant human-made object, has been in space for more than 25 years and it still has not escaped the influence of our Sun. As of July 19, 2004, Voyager 1 was about 13,800,000,000 km from the Sun - more than twice the distance from the Sun to icy Pluto.

Needless to say, our solar system doesn't fit real well on paper - or a Web site for that matter.

Scientists figured out a while ago that writing out those huge numbers wasn't the best use of their time so they invented the Astronomical Unit (AU). One AU - 150,000,000 km represents the average distance from the Sun to the Earth. It would take an airliner more than 20 years to fly that distance - and that's just a one-way ticket. (That's traveling at about 644 km per hour.)

In another effort to bring these vast distances down to Earth, we've shrunk the solar system down to the size of a football field.

On this scale, the Sun - by far the largest thing in our solar system - is only a ball about 17 mm in diameter sitting on the goal line - that's about the width of a U.S. dime coin.

Considering a typical honeybee is about 12 mm long, the fans are going to need telescopes to see the action.

The inner planets - Mercury, Venus, Earth and Mars - are about the size of grains of sand on a football field scale. They would be dwarfed by a typical flea, which is about 3 mm long.

Image to right: On a football field scale, the Sun is about as big as a dime. Credit: NASA

Closest to the goal line is Mercury, just under a yard from the end zone (.8 yards to be specific). In reality, the average distance from the Sun to Mercury is roughly 58,000,000 km (35,000,000 miles) or 0.4 AU. At this scale, Mercury's 0.06 mm diameter is scarcely as large as the point of a needle.

Venus is next. It is 1.4 yards from the end zone. The true average distance from the Sun to Venus is about 108,000,000 km (67,000,000 miles) or 0.7 AU. Its size on this scale is about 0.15 mm.

On to Earth, sitting pretty on the 2-yard line. It is slightly larger than Venus at about 0.16 mm.

Just as most quarterbacks would be extremely pleased to find their team within two yards of a touchdown, Earth reaps many benefits from this prime location in the solar system. We are at the perfect distance from the Sun for life to flourish. Venus is too hot. Mars is too cold. Scientists sometimes call our region of space the "Goldilocks Zone" because it appears to be just right for life.

As noted earlier, Earth's average distance to the Sun is about 150,000,000 km (93,000,000 miles) from the Sun. That's 1 AU.

Mars is on the three-yard line of our imaginary football field. The red planet is about 228,000,000 km (142,000,000 miles) on average from the Sun. That's 1.5 AU. On this scale, Mars is about 0.08 mm.

Asteroids roam far and wide in our solar system. But most are contained within the main asteroid belt between Jupiter and Mars. On our football field, you'd find them scattered like so many slow-moving linebackers between the four and eight yard lines. In real distances that's an average of roughly 300,000,000 to 600,000,000 km (186,000,000 to 372,000,000 miles) from the Sun, or 2 to 4 AU.

On this imaginary scale, these so-called "linebackers" are more like microscopic specks than the real hulking linebackers that play for the NFL. (If you could lump together all the thousands of known asteroids in our solar system, their total mass wouldn't even equal 10 percent of Earth's moon.)

Jupiter remains pretty close to our end zone on the 10.5-yard line. Our solar system's largest planet is an average distance of 778,000,000 km (484,000,000 miles) from the Sun. That's 5.2 AU. Jupiter is the largest of the planets, spanning nearly 1.75 mm in diameter on our football field scale. Jupiter's diameter is about equal to the thickness of a U.S quarter in our shrunken solar system.

Saturn is on the field at 19 yards from the goal line. The ringed world is about 1,427,000,000 km (887,000,000 miles) from the Sun, or 9.5 AU. Saturn's size on this scale: 1.47 mm.

Uranus is about the point where our cosmic coach would call in an interplanetary field goal kicker. The gas giant is about 38 yards from our end zone. In real distances, that's an average of 2,871,000,000 km (1,784,000,000 miles) - 19 AU - from the Sun. That's quite a kick. It's little wonder only one spacecraft has visited Uranus. At 0.62 mm on this scale, Uranus is just a little smaller than the letter "R" in the word "TRUST" on a penny.

Neptune is where things start to get way out. It is 60 yards from our solar goal line on the imaginary football field. That's an average of 4,498,000,000 km (2,795,000000 miles) or 30 AU from the real Sun. Neptune, a little smaller than Uranus, is 0.6 mm on this scale.

Tiny Pluto is much closer to the opposing team's end zone. It's about 79 yards out from the Sun or 5,906,000,000 km (3,670,000,000 miles) on average in real distances. That's 39.5 AU.

On this scale, our little friend Voyager 1 has left the game and is well out in the stadium parking lot. The spacecraft is traveling away from the Sun at about 3.5 AU per year. That's about 525,000,000 km a year or 1,440,000 km a day (326,000,000 miles a year or 890,000 miles a day).

Think about it.

Office of Space Science

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