<u>Umbrella Sky as a Model for Celestial Motion</u>
Student Sheet

Directions: Each group has been given a large domed umbrella, a variety of craft supplies, and a list of star coordinates. Your goal is to create a celestial sphere model with enough detail that you are able to mark the star locations on it and match the shape to a known constellation. You should also be able to demonstrate the motion of the sun from different locations on Earth: the north pole, 45 degrees north latitude, and the equator.

1. Before creating your umbrella sky, identify the parts of the model that correspond to different parts of the sky:
    a. Equator -
    b. Celestial North Pole -
    c. Celestial Equator -
    d. Lines of Right Ascension -
2. Using the craft supplies, add these features to your umbrella. You may use markers, but consider making the model tactile and colorful. Chenille sticks are sharp enough to be sewn into the plastic by poking them through the plastic.
    a. Label the following lines of right ascension: 0, 3, 9, 12, 15, 18, 21, 24
    b. For at least one section of the umbrella, mark three lines of declination. Do this by dividing the length of the section from edge to point into four. Each will be at 22.5 degrees above the one below it on the dome.
    c. Mark the ecliptic.
3. Create a movable sun marker for your model. Begin by placing it at the spring equinox. Rotate your umbrella to model the motion of the sun from sunrise to sunset on the first day of spring. Do the same for the first day of summer (summer solstice) and the first day of fall (autumnal equinox).
    a. Our model does not include a horizon. How did you imagine or create a horizon for your sun motions?
    b. Identify the cardinal directions on your model. Where is north, south, east and west?
    c. Comparing the three motions, how does the sunrise position relative to the horizon change with each season?
    d. Comparing the three motions, how does the sunset position relative to the horizon change with each season?
    e. Demonstrate your model for your teacher before going on.

4. Once you have a completed celestial sphere model, your teacher will give you a set of stellar coordinates. Using what you know about your model, mark the stars on your umbrella. Can you identify your constellation? Ask your teacher for a reference document if you need help.
5. For each of the days that you modeled above, observe the motion of your constellation. Describe what you observe.
6. Considering the model itself, what are some of it's strengths and weaknesses?