

## Montessori Lesson Plan

School: N/A	Teacher: Kathlyn Videkovich
Subject/Topic(s): Electromagnetic Waves and the formation of the universe	
Grade Level: 9	Theme: Our Universe, Our place
Curriculum Components Included: <input type="checkbox"/> Project <input checked="" type="checkbox"/> Mini-Whole Grp <input checked="" type="checkbox"/> Lesson-Small Grp <input checked="" type="checkbox"/> Student engagement during lesson <input checked="" type="checkbox"/> Shelfwork <input type="checkbox"/> Rubric <input type="checkbox"/> Self-Assessment <input type="checkbox"/> Seminar/Qs <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Outside Opportunity	
Seven Gateways for Adolescence addressed in this lesson: <input type="checkbox"/> Deep Connection <input type="checkbox"/> Silence & Solitude <input checked="" type="checkbox"/> Meaning & Purpose <input type="checkbox"/> Joy & Delight <input type="checkbox"/> Creative <input type="checkbox"/> Transcendence <input type="checkbox"/> Initiation	

<u>Standards/Objectives</u> <b><u>Standards: From Wisconsin Science Standard [1]</u></b> Standard SCI.ESS1: Students use science and engineering practices, crosscutting concepts, and an understanding of earth's place in the universe to make sense of phenomena and solve problems. SCI.ESS1.A.h Light spectra from stars are used to determine their characteristics, processes, and lifecycles. Solar activity creates the elements through nuclear fusion. The development of technologies has provided the astronomical data that provide the empirical evidence for the Big Bang theory. SCI.PS4: Students use science and engineering practices, crosscutting concepts, and an understanding of waves and their applications in technologies for information transfer to make sense of phenomena and solve problems SCI.PS4.A.h The wavelength and frequency of a wave are related to one another by the speed of the wave, which depends on the type of wave and the medium through which it is passing. Waves can be used to transmit information and energy SCI.PS4.B.h Both an electromagnetic wave model and a photon model explain features of electromagnetic radiation broadly and describe common applications of electromagnetic radiation <b><u>Objectives:</u></b> Explain where light originates from Explain that light is made of electromagnetic waves Explain that different sources of light have different color spectrums. Explain how we know there are electromagnetic waves that are outside of the visible spectrum Explain how a prism works with regards to waves speed Describe how the electromagnetic waves are used to investigate the universe and related technologies		
<u>Materials: Teacher</u> <ul style="list-style-type: none"> <li>• Marker board with marker</li> <li>• Picture of the electromagnetic Spectrum</li> <li>• Finished models that the students are going to build and use</li> </ul>	<u>Materials: Student</u> <ul style="list-style-type: none"> <li>• Notebook</li> <li>• Pencil</li> <li>• Access computer with internet and printer</li> <li>• General school room supplies for shelf work</li> </ul>	<u>Time/Dates</u> <ul style="list-style-type: none"> <li>• 09/20 – 09/23</li> </ul>
<u>Facts/Skills (Prior Knowledge)</u> <ul style="list-style-type: none"> <li>• Behaviors of waves</li> <li>• Light Spectrum</li> <li>• History of the telescope</li> <li>• What happened during the Big Bang</li> </ul>		<u>Concepts/Big Ideas</u> <ul style="list-style-type: none"> <li>• Electromagnetic waves are “visible” throughout our universe and there is background radiation</li> <li>• Leads into the concept of the expanding universe</li> </ul>
<u>Lesson Relates to Theme</u> (Note: Every content lesson will not directly relate to the theme) This lesson relates to “How do we know our place in the universe”		

Connection to Elementary Material or Lesson

Connects with ETC Montessori materials for Light and Physical science curriculum.

## Step-by-Step Procedures

### 1<sup>st</sup> Period Lesson – 20 minutes (Include steps and materials)

- Discuss what is light – How does light come into being?
- Present concept of the electromagnetic spectrum with picture of electromagnetic spectrum
- Describe how we can break apart light into its components by having it travel through a different medium. Show Prism, show water, show grater. Show illustration of refraction.
- Discuss the visible spectrum – allude back to work that was done in Middle school and elementary school with rainbows
- Introduce the stereograph and how science used it to look at the universe.
- Introduce stereograph shelf work. Explain how the stereograph breaks lights into its components. Give brief overview of expectations of need to do a graph for the sun and another source of light. SAFETY - DO NOT LOOK DIRECTLY AT THE SUN
- Show electromagnetic spectrum again and point out area beyond visible red light and ask students how do we know it is there? How have we experienced it? Give description of The Herschel Experiment and introduce the shelf work with associated instruction and prompt cards.
- Show the electromagnetic spectrum again and point out the area on the other side of the visible violet light. Ask students questions on how do we know that it is there? What are our concerns with UV light? Discuss how UV light paper works and introduce activity three.
- Discussion about how science uses the electromagnetic spectrum to observe the universe beyond the standard telescope.
- Introduce the mini research project to understand the different technologies used to analyze the big bang and how knowledge of the electromagnetic spectrum is used today

### 2<sup>nd</sup> Period – Recognition (Shelfwork)

- Three-part cards with definitions for key terms related to the lesson
- Three-part cards with historic technologies and how they are used

### 2<sup>nd</sup> Period – Recall Practice

- Building and use a stereograph and plotting the patterns of light from different sources.
  - Indirectly view the sun and make a graph of the colors
  - View other sources of white light and graph the colors
  - Record Observations
- Herschel Experiment - Use prism box to measure the temperature of colors and to find infrared – Construct a plot of the different temperature colors of light from the sun. Answer prompt questions from cards.
- Use UV sensitive paper to find things that omit UV light and things block UV light. Record observations.
- Research one application of how the electromagnetic spectrum is used to make observations on the universe and in the world around us. Prompt cards will be provided.
  - Level 1 report – pick a research card and find basic facts of how, what, where, and when.
  - Level 2 report – Research covers Level 1 and links the technology to how it was used to make observations about the expansion of the universe
- Level 3 – Expanse level two reports with what is the modern day usage of the

		technology – where is the cutting edge of the research
<u>3<sup>rd</sup> Period – Student Application</u> <ul style="list-style-type: none"> <li>• Present the results of their investigations to teacher (Graphs and discussions)</li> <li>•</li> </ul>		
Plan for Differentiation		
<u>Teaching</u> General lesson will be provided to all students in the same session. Mini- support lessons will be provided when the students do the hands-on experiments/activities and are looking at the data and support cards.	<u>Work</u> All students will do the three experiments/activities – Mini lessons will be provided to those that need them.  For the research, the students can select topics from research idea cards.	<u>Assessment</u> Graphs and observations will be grade on the same grading scale Report's grading will be differentiated and have differentiated requirements.
Outside Support: Who, What, How		
Formal Assessments		
<u>Formative Assessments</u> As the students work on the lesson activities conduct spot checks and ask them questions about how they feel they are going, are things working, has the activities spark further questions. For the stereograph, where they able to see and record the full spectrum of light? Did the fins sources of light that were “white” but did not have a full spectrum (LED)? For the Herschel experiment, did you find the IR? How do you know you found it? Can you show me how you know (ie show me the graph)?		
<u>Summative Assessment</u> Level 1 – Student has successful produced graphs of two different light sources, the color temperature graph and has found one way to block UV light.  The report covers the basic of Who, What, Where, How and When the technology was used to make a discovery. Grading will be based on understanding of facts directly related to the topic.  Level 2- Student has successful produced graphs of two or more different light sources, the color temperature graph and has found multiple ways to block UV light.  Report covers the Who, What, Where, How and When the technology was used to make a discovery and provides a discussion that demonstrates the understanding of the implications of the discovery on the Big Bang theory.  Level 3 - Student has successful produced graphs of more than three different light sources, the color temperature graph and has found multiple ways to block UV light.  Report – The report will expand on Level 2 with a discussion on the impacts of the technology for analyzing the big band but also expanse into how the technology is used today.		