Lunar Meteor Schedule and Observing Plan for 2021

This form outlines the plan to monitor the moon on a regular basis both inside and outside normal annual showers. Each month, for a total of up to 14 days per month, we are coordinating observations of the Earthshine portion of the moon for background (including the minor showers when they fall during this time) meteor impact flux. A typical run of observations starts three days after New Moon and continues until two days past First Quarter. The run resumes two days before Last Quarter and continues until three days prior to New Moon. The actual interval will depend on the lunar elevation and elongation as well as the ability of the observer to control stray light in one’s system.

### Table

<table>
<thead>
<tr>
<th>Shower</th>
<th>Activity</th>
<th>Maximum Date</th>
<th>Radiant λ</th>
<th>V_∞</th>
<th>r</th>
<th>ZHR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Antihelion Source (ANT)</strong></td>
<td>Dec 10 – Sep 10</td>
<td>Mar-Apr, late May, late June</td>
<td>283.15°</td>
<td>230°</td>
<td>+49°</td>
<td>41</td>
</tr>
<tr>
<td>Quadrantids (010 QUA)</td>
<td>Dec 28 - Jan 12</td>
<td>Jan 03</td>
<td>298°</td>
<td>228°</td>
<td>+67°</td>
<td>31</td>
</tr>
<tr>
<td>γ-Ursae Minorids (404 GUM)</td>
<td>Jan 10 - Jan 22</td>
<td>Jan 19</td>
<td>319.2°</td>
<td>210°</td>
<td>-59°</td>
<td>58</td>
</tr>
<tr>
<td>α-Centaurids (102 ACE)</td>
<td>Jan 31 - Feb 20</td>
<td>Feb 08</td>
<td>32.32°</td>
<td>271°</td>
<td>+34°</td>
<td>49</td>
</tr>
<tr>
<td>γ-Normids (118 GNO)</td>
<td>Feb 25 - Mar 28</td>
<td>Mar 14</td>
<td>354°</td>
<td>239°</td>
<td>-50°</td>
<td>56</td>
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<tr>
<td>Lyrids (006 LYR)</td>
<td>Apr 14 - Apr 30</td>
<td>Apr 22</td>
<td>33.5°</td>
<td>110°</td>
<td>-45°</td>
<td>18</td>
</tr>
<tr>
<td>π-Puppids (137 PPU)</td>
<td>Apr 15 - Apr 28</td>
<td>Apr 23</td>
<td>45.5°</td>
<td>338°</td>
<td>-91°</td>
<td>66</td>
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<tr>
<td>η-Aquarids (031 ETA)</td>
<td>Apr 19 - May 28</td>
<td>May 08</td>
<td>48.0°</td>
<td>287°</td>
<td>+44°</td>
<td>43</td>
</tr>
<tr>
<td>η-Lyrids (145 ELY)</td>
<td>May 03 - May 14</td>
<td>May 08</td>
<td>95.7°</td>
<td>224°</td>
<td>+48°</td>
<td>18</td>
</tr>
<tr>
<td>June Bootids (170 JBO)</td>
<td>Jun 22 - Jul 02</td>
<td>Jun 27</td>
<td>125°</td>
<td>341°</td>
<td>-30°</td>
<td>35</td>
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<tr>
<td>Piscis Austr. (183 PAU)</td>
<td>Jul 15 - Aug 10</td>
<td>Jul 29</td>
<td>127°</td>
<td>307°</td>
<td>-10°</td>
<td>23</td>
</tr>
<tr>
<td>South. δ-Aqr (005 SDA)</td>
<td>Jul 12 - Aug 23</td>
<td>Jul 30</td>
<td>127°</td>
<td>307°</td>
<td>-10°</td>
<td>23</td>
</tr>
<tr>
<td>α-Capricorn. (001 CAP)</td>
<td>Jul 03 - Aug 15</td>
<td>Jul 30</td>
<td>127°</td>
<td>307°</td>
<td>-10°</td>
<td>23</td>
</tr>
<tr>
<td>Perseids (007 PER)</td>
<td>Jul 17 - Aug 24</td>
<td>Aug 12</td>
<td>140.0°</td>
<td>48°</td>
<td>+58°</td>
<td>59</td>
</tr>
<tr>
<td>κ-Cygnids (012 KCG)</td>
<td>Aug 03 - Aug 25</td>
<td>Aug 17</td>
<td>145°</td>
<td>286°</td>
<td>+59°</td>
<td>25</td>
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<tr>
<td>Aurigids (206 AUR)</td>
<td>Aug 28 - Sep 05</td>
<td>Sep 01</td>
<td>158.6°</td>
<td>91°</td>
<td>+39°</td>
<td>66</td>
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<tr>
<td>Sep. ε-Per (208 SPE)</td>
<td>Sep 05 - Sep 21</td>
<td>Sep 09</td>
<td>166.7°</td>
<td>48°</td>
<td>+40°</td>
<td>64</td>
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<tr>
<td>Oct. Camelon. (281 OCT)</td>
<td>Oct 05 – Oct 06</td>
<td>Oct 05</td>
<td>192.58°</td>
<td>164°</td>
<td>+79°</td>
<td>47</td>
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<tr>
<td>Dracoids (009 DRA)</td>
<td>Oct 06 – Oct 10</td>
<td>Oct 08</td>
<td>195.4°</td>
<td>262°</td>
<td>+54°</td>
<td>20</td>
</tr>
<tr>
<td>S. Taurids (002 STA)</td>
<td>Sep 10 - Nov 20</td>
<td>Oct 10</td>
<td>197°</td>
<td>32°</td>
<td>+9°</td>
<td>27</td>
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<tr>
<td>δ-Aurigids (224 DAU)</td>
<td>Oct 10 - Oct 18</td>
<td>Oct 11</td>
<td>198°</td>
<td>84°</td>
<td>+44°</td>
<td>64</td>
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<tr>
<td>ε-Geminids (023 EGE)</td>
<td>Oct 14 - Oct 27</td>
<td>Oct 18</td>
<td>205°</td>
<td>102°</td>
<td>+27°</td>
<td>70</td>
</tr>
<tr>
<td>Orionids (008 ORI)</td>
<td>Oct 02 - Nov 07</td>
<td>Oct 01</td>
<td>208°</td>
<td>95°</td>
<td>+16°</td>
<td>66</td>
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<tr>
<td>Leo Minorids (022 LMI)</td>
<td>Oct 19 – Oct 27</td>
<td>Oct 24</td>
<td>211°</td>
<td>162°</td>
<td>+37°</td>
<td>62</td>
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<tr>
<td>N. Taurids (017 NTA)</td>
<td>Oct 20 – Dec 10</td>
<td>Nov 12</td>
<td>230°</td>
<td>58°</td>
<td>+22°</td>
<td>29</td>
</tr>
<tr>
<td>Leonids (013 LEO)</td>
<td>Nov 06- Nov 30</td>
<td>Nov 17</td>
<td>235.27°</td>
<td>152°</td>
<td>+22°</td>
<td>71</td>
</tr>
<tr>
<td>α-Monocerotids (246 AMO)</td>
<td>Nov 15 – Nov 25</td>
<td>Nov 21</td>
<td>239.32°</td>
<td>117°</td>
<td>+10°</td>
<td>65</td>
</tr>
<tr>
<td>Nov. Ori. (250 NOO)</td>
<td>Nov 13 – Dec 06</td>
<td>Nov 28</td>
<td>246°</td>
<td>91°</td>
<td>+16°</td>
<td>44</td>
</tr>
<tr>
<td>Phoenicids (254 PHO)</td>
<td>Nov 28 - Dec 09</td>
<td>Dec 02</td>
<td>250.0°</td>
<td>18°</td>
<td>-53°</td>
<td>18</td>
</tr>
<tr>
<td>Puppid-Vel. (301 PUP)</td>
<td>Dec 01 – Dec 15</td>
<td>Dec 07</td>
<td>255°</td>
<td>123°</td>
<td>-45°</td>
<td>40</td>
</tr>
<tr>
<td>Monocerot. (019 MON)</td>
<td>Dec 05 – Dec 20</td>
<td>Dec 09</td>
<td>257°</td>
<td>100°</td>
<td>+08°</td>
<td>41</td>
</tr>
<tr>
<td>σ-Hydras (016 HYD)</td>
<td>Dec 03 – Dec 20</td>
<td>Dec 09</td>
<td>260°</td>
<td>127°</td>
<td>+03°</td>
<td>58</td>
</tr>
<tr>
<td>Geminids (004 GEM)</td>
<td>Dec 04 – Dec 20</td>
<td>Dec 14</td>
<td>262.2°</td>
<td>112°</td>
<td>+33°</td>
<td>35</td>
</tr>
<tr>
<td>Com. Berenic. (020 COM)</td>
<td>Dec 12 - Dec 23</td>
<td>Dec 16</td>
<td>264°</td>
<td>175°</td>
<td>+18°</td>
<td>65</td>
</tr>
<tr>
<td>Dec. L Minorids (032 DLM)</td>
<td>Dec 05 – Feb 04</td>
<td>Dec 19</td>
<td>268°</td>
<td>161°</td>
<td>+30°</td>
<td>64</td>
</tr>
<tr>
<td>Ursids (015 URS)</td>
<td>Dec 17 - Dec 26</td>
<td>Dec 22</td>
<td>270.7°</td>
<td>217°</td>
<td>+76°</td>
<td>33</td>
</tr>
</tbody>
</table>

Table. Working list of meteor showers, courtesy of the International Meteor Organization.
Observations of the moon during annual showers will occur during routine monthly observations, but observers who are limited in terms of time spent observing are encouraged to plan for annual showers first of all and to observe for a day or two either side of (and including) shower maximum.

The table on the previous page, from the Working list of meteor showers published annually at [www.imo.net](http://www.imo.net) (the International Meteor Organization) shows information about the annual showers. Entries in bold delineate a shower that is favored for lunar activity, that is, when maximum occurs during the specified interval. The shower name and IMO designation is given in the first column. The interval of activity is presented in the second column with the date of maximum (Earth-based) in the third column. The velocity of the meteoroids at infinity is presented in the next column, which is followed by the population index. The population index, r, is a measure of the distribution of meteoroid sizes at maximum. A larger value of r indicates a larger proportion of smaller particles and is less favorable for lunar meteor studies. Smaller r-values indicate more large particles, translating into a greater probability of observing lunar impacts. Finally, the Zenithal Hourly Rate, as observed on Earth, is given.

We encourage observers to watch the moon a day or two before and after the predicted peak date of an annual shower. The difference in ZHR peak time from Earth to the moon is up to ± 7 hours...later for evening phase, earlier for morning phase. Some showers, such as the Orionids, have a broader peak, while others like the Quadrantids have a narrow peak. The dates of monthly observations are given in the next table. The cut-off dates for one’s observing program will vary with year and latitude of observer, which affects the ecliptic angle and the lunar visibility.

<table>
<thead>
<tr>
<th>Last Quarter</th>
<th>Observing Interval</th>
<th>New Moon</th>
<th>Observing Interval</th>
<th>First Quarter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mar. 6</td>
<td>Mar. 4 – 10</td>
<td>Mar. 13</td>
<td>Mar. 16 – 23</td>
<td>Mar. 21</td>
</tr>
<tr>
<td>Apr. 4</td>
<td>Apr. 2 – 9</td>
<td>Apr. 12</td>
<td>Apr. 15 – 22</td>
<td>Apr. 20</td>
</tr>
<tr>
<td>May 3</td>
<td>Apr. 30 – May 8</td>
<td>May 11</td>
<td>May 14 – 21</td>
<td>May 19</td>
</tr>
<tr>
<td>June 2</td>
<td>May 31 – June 7</td>
<td>June 10</td>
<td>June 13 – 20</td>
<td>Jun. 18</td>
</tr>
<tr>
<td>July 1</td>
<td>June 29 – July 7</td>
<td>July 10</td>
<td>July 13 – 19</td>
<td>Jul. 17</td>
</tr>
<tr>
<td>July 31</td>
<td>July 29 – Aug. 5</td>
<td>Aug. 8</td>
<td>Aug. 11 – 17</td>
<td>Aug. 15</td>
</tr>
<tr>
<td>Aug. 30</td>
<td>Aug. 28 – Sep. 4</td>
<td>Sep. 7</td>
<td>Sep. 10 – 15</td>
<td>Sep. 13</td>
</tr>
<tr>
<td>Oct. 28</td>
<td>Oct. 26 – Nov. 11</td>
<td>Nov. 4</td>
<td>Nov. 7 – 13</td>
<td>Nov. 11</td>
</tr>
<tr>
<td>Nov. 27</td>
<td>Nov. 25 – Dec. 1</td>
<td>Dec. 4</td>
<td>Dec. 7 – 13</td>
<td>Dec. 11</td>
</tr>
</tbody>
</table>

Any questions concerning this plan can be directed to the ALPO Lunar Meteoritic Impact Search Coordinator, Mr. Brian Cudnik, at bmcudnik@gmail.com.