Short paper

**Eta Aquarids 2013 – Dual-station meteor videography**

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**Equipment and methods**

NEMETODE members William Stewart (WS) and Alex Pratt (ARP) employed the same equipment and methods as described in their paper on the 2012 Geminids and on the NEMETODE website.

**The eta Aquarid meteor stream**

The eta Aquarids (MDC reference 031 ETA) are active from mid-April to late May with a ZHR of ~55 at maximum. Their parent body is comet 1P/Halley, which also produces the Orionids (008 ORI) during October and early November. As viewed from mid-northern latitudes the low declination radiant of the eta Aquarids rises shortly before dawn, making observations in the morning twilight difficult. The resulting ‘Earth-grazers’ do however produce characteristic long-pathed trails.

**Results**

The first probable eta Aquarid candidate was recorded on 2013 April 15/16 (Ravensmoor N) and the last on 2013 May 25/26 (Ravensmoor SE). The magnitude distribution of 51 eta Aquarids captured during this period (measured by UFO Analyser) is given in Table 1.

**Dual-station eta Aquarids**

_UFO Orbit_ supports three built-in quality assurance criteria:
- Q1 – minimum criteria for radiant computation
- Q2 – standard criteria for radiant and velocity computation
- Q3 – criteria for high precision computation

Between 2013 April 28/29 and May 12/13 a total of 10 Q1-level dual-station eta Aquarids was recorded.

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**Radiant drift**

_UFO Orbit_ was used to derive the radiant point for each dual-station eta Aquarid, corrected for zenith attraction. These were used to estimate the daily drift of the radiant in right ascension and declination.

The method of least squares gives the linear fits:

\[
\begin{align*}
\text{RA} &= 0.663 \times \lambda_{\text{solar}} + 307.54 \\
\text{Dec} &= 0.234 \times \lambda_{\text{solar}} - 11.564
\end{align*}
\]

where \(\lambda_{\text{solar}}\) is solar longitude (°) and \(r\) is the correlation coefficient.

If we assume that eta Aquarid maximum occurred at solar longitude 45°, the estimated values of RA and Dec, and daily motion in RA (dRA°) and Dec (dDec°) are presented in Table 2 for comparison with other sources.

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**Detection and extinction altitudes**

_UFO Orbit_ computed the detection and extinction altitudes of 8 Q2 eta Aquarid meteors and their absolute magnitudes, captured between 2013 April 28/29 and May 6/7 (see Figure 3). (Note: Absolute magnitude is the magnitude the meteor would have if it was in the zenith, 100km above the observer.)
Table 2. The position of the eta Aquarid radiant at maximum and its daily motion

<table>
<thead>
<tr>
<th></th>
<th>$\lambda_{\text{Solar}}$ (°)</th>
<th>$RA$ (°)</th>
<th>RA dRA (°)</th>
<th>Dec (°) dDec (°)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEMETODE</td>
<td>45</td>
<td>337.4</td>
<td>22h 30m</td>
<td>0.66</td>
</tr>
<tr>
<td>BAA</td>
<td>45</td>
<td>335</td>
<td>22h 20m</td>
<td>0.9</td>
</tr>
<tr>
<td>IAU MDC$^5$</td>
<td>46.9</td>
<td>339.0</td>
<td>22h 36m</td>
<td>0.73</td>
</tr>
<tr>
<td>IMO</td>
<td>47</td>
<td>339.1</td>
<td>22h 36m</td>
<td>0.64</td>
</tr>
<tr>
<td>SonotaCo$^7$</td>
<td>46.3</td>
<td>338.3</td>
<td>22h 33m</td>
<td>0.62</td>
</tr>
</tbody>
</table>

Figure 2. eta Aquarid radiant drift in declination.

Figure 3. Detection and extinction altitudes of 8 Q2 eta Aquarid meteors.

The small difference between some of the detection and extinction altitudes is a consequence of the low-elevation radiant leading to meteor trails that are almost parallel to the Earth’s surface.

Geocentric velocities

UFO Orbit computed the geocentric velocities ($V_g$) of the 8 Q2 eta Aquarid meteors, which gave the following:

Mean 66.0 km/s
Standard deviation 0.7 km/s

These are compared with other sources in Table 3.

Table 3. Geocentric velocities of 8 Q2 eta Aquarid meteors

<table>
<thead>
<tr>
<th></th>
<th>$V_g$ (km/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEMETODE</td>
<td>66.0</td>
</tr>
<tr>
<td>IAU MDC$^5$</td>
<td>65.0</td>
</tr>
<tr>
<td>IMO$^6$</td>
<td>67.4</td>
</tr>
<tr>
<td>SonotaCo$^7$</td>
<td>65.4</td>
</tr>
</tbody>
</table>

Table 4. Orbital elements of 3 Q3 eta Aquarid meteors, IAU MDC shower data & parent body comet 1P/Halley

<table>
<thead>
<tr>
<th>Solar long.</th>
<th>Abs mag</th>
<th>$V_g$</th>
<th>a (au)</th>
<th>q (au)</th>
<th>e</th>
<th>p</th>
<th>Peri</th>
<th>Node</th>
<th>Incl</th>
</tr>
</thead>
<tbody>
<tr>
<td>44.624317</td>
<td>−1.6</td>
<td>65.8</td>
<td>14.439</td>
<td>0.577</td>
<td>0.960</td>
<td>54.889</td>
<td>97.217</td>
<td>44.625</td>
<td>163.695</td>
</tr>
<tr>
<td>45.522839</td>
<td>−0.9</td>
<td>64.9</td>
<td>6.569</td>
<td>0.559</td>
<td>0.915</td>
<td>16.842</td>
<td>93.814</td>
<td>45.523</td>
<td>164.023</td>
</tr>
<tr>
<td>45.579281</td>
<td>−3.6</td>
<td>65.7</td>
<td>11.951</td>
<td>0.578</td>
<td>0.952</td>
<td>41.332</td>
<td>97.173</td>
<td>45.579</td>
<td>163.816</td>
</tr>
</tbody>
</table>

Mean 45.2
Std. dev. 0.5

IAU MDC$^5$ 46.9
1P/Halley$^8$ 65.0

References

2 http://www.nemetode.org/
3 http://imo.net/calendar/2013#eta
4 BAA Handbook 2013, 98 (from NASA SP-319, pp. 185–186, 1973)
5 http://tinyurl.com/qyotgas
8 http://ssd.jpl.nasa.gov/sbdb.cgi?ID=c00001_0

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