

**Summary of von Zach's *Monthly Correspondence*, Volume 4, LVII: "Continued Reports concerning the long-conjectured new Major Planets of our Solar System" (1801 December, pp. 638-649).**

Page 638 von Zach explains why from the end of 1801 February, up to 1801 December, the newly-discovered minor planet Ceres had not been observed. He attributes this situation to the often-overcast skies in northern Europe.

von Zach notes that a successful systematic search requires that the skies be favorable over many successive nights; that is, whenever the night skies are overcast for an extended period, then the search must start all over again when the night skies are again clear.

Page 639 von Zach discusses the orbital predictions of Gauss vs. those of Burckhardt, Olbers and Piazzi. He stresses the need for other European astronomers to help in the search for Ceres.

Page 640 von Zach puts his credence with the elliptical orbit of Gauss.

Page 641 von Zach provides a table with preliminary orbital elements of Ceres as calculated by Gauss. von Zach notes that Gauss started with the three Piazzi observations for 1801 January 2, January 22, and February 11, but after further analysis, chose to work with the observations for 1801 January 1, January 21, and February 11. von Zach then gives yet another set of preliminary orbital elements calculated by Gauss following Gauss's analysis of all 19 usable observations, as reported in MC Vol. 4, p. 280.

Page 642 von Zach provides a table with the geocentric ecliptic longitudes and latitudes, and their errors, as calculated by Gauss from the preliminary orbital elements of Ceres given on p. 641.

Page 643 von Zach reports on correspondence among von Zach, Piazzi, and Gauss, concerning which Piazzi corrects his calculated geocentric ecliptic longitudes and latitudes, and Gauss calculates another set of preliminary orbital elements, as given on the top of page 644.

Page 644 In the first table, von Zach provides third set of preliminary orbital elements for Ceres as calculated by Gauss. In the second table, which is similar to the table at the top of p. 642, von Zach provides the calculated geocentric ecliptic longitudes and latitudes and their errors.

Page 645 von Zach further discusses the results on p. 644.

Page 646 von Zach further discusses the results and reports that Gauss has done a fourth and final calculation of the orbital elements of Ceres prior to its recovery, which elements are to be found on p. 647.

Page 647 von Zach provides Gauss's fourth set of preliminary orbital elements for Ceres. This is the final calculation of the orbital elements of Ceres prior to von Zach's recovery of Ceres on the night of December 7 and again on the night of 1801 December 31 - 1802 January 1.

Page 647, continued von Zach then provides the most important information in the MC article\*, the Gaussian search ephemeris for Ceres that von Zach used to search for and successfully recover Ceres.

This search ephemeris of Gauss, even more than the fourth set of preliminary orbital elements, is the very most important part of the entire MC article.

(\*The second most important part of the MC article is the fact that Gauss determined the orbit of Ceres from the Piazzi observations made on 1801 January 1, January 21, and February 11, and not from the observations made on 1801 January 2, January 22, and February 11, as has been widely and erroneously reported.)

Page 648 von Zach provides the equations by which the reader can carry Gauss's own search ephemeris calculations to greater precision, or can extend the predictions to other dates.

Page 649 von Zach discusses the orbit of Ceres relative to that of Earth and the other known major planets of our solar system.

#### Concluding Remarks

The lasting value of von Zach's Monthly Correspondence (MC) regarding Ceres in 1801 December is that it provides, on p.647, the Ceres search ephemeris of Gauss that von Zach used to search for and recover Ceres.

This search ephemeris is only expressed to the nearest arc-minute of angle rather than to the nearest arc-second. So preliminary orbit determination on the seven Gaussian geocentric ecliptic positions, as tabulated by von Zach, cannot exactly reproduce Gauss's search elements.

However, upon converting the geocentric ecliptic longitudes and latitudes in the search ephemeris to right ascensions and declinations, we find close agreement with those that we can calculate using modern orbit determination algorithms that work with the three observations chosen by Gauss (see again p. 641).

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(This Summary was prepared to be used in conjunction with the German text of von Zach cited above. Both .pdf files were prepared as background research for my AMOS 2016 paper with Dr. Gim J. Der, "Reconstruction of the 1801 Discovery Orbit of Ceres via Contemporary Angles-Only Algorithms.")