For the bottom of p. 139, column 1:
In this way we got a parallactic shift of Mercury with respect to the photosphere of p = 8.86 arcseconds. This angle is smaller than Mercury's parallax p_M with respect to the stars because the Sun itself shows a parallactic shift p_s relative to the stars in the same direction. Therefore, the angle p is smaller than p_M by the (at the time of the simultaneous observations) unknown angle p_S:

$$p = p_M - p_S$$

The parallaxes are inversely proportional to the corresponding distances d_M and d_S from Earth. By using instead the distances of Earth and Mercury from the Sun, r_E and r_M, we get the following equation:

$$p_M/p_S = d_S/d_M = r_E/(r_E - r_M).$$

By combining these equations, we are able to derive the parallaxes P_M of Mercury and P_S of the Sun from the measured angle p:

$$p_M = (r_E/r_M)p \text{ and } p_S = (r_E/r_M - 1)p.$$

For this calculation, only the actual proportion between the distances of Mercury and Earth from the Sun must be known. With the known value r_M/r_E = 0.4529/1.0097 (see below) we get

$$p_M = 19.75 \text{ arcseconds and } p_S = 10.89 \text{ arcseconds.}$$

In order to derive the distance between Earth and the Sun we additionally must determine the corresponding baseline, that is, the distance between the observation sites from the perspective of the Sun. See also http://www.venus2012.de/transit-of-mercury2016/stuff/TransitofMercury2016.pdf

For the top of page 139 column 2:
This line is not perpendicular to the direction to the Sun. In order to calculate the angle of projection, the equatorial coordinates of the Sun (α = 46.794°, d = 17.535°) and of both observation sites must be known. At the time of photographing, the coordinates of BBSO were $\alpha = 23^h53^m34^s$ = 358.392° (the local sidereal time), δ = 34.259° (its latitude) and those of Weiden were $\alpha = 08^h29^m51^s$ = 127.463°, δ = 49.6667°. After having transformed them into rectangular coordinates and calculated the vector pointing from BBSO to Weiden, the inner product between the directions BBSO–Weiden and Earth–Sun gives the cosine of the projection angle (68.7°). This angle shortens the line of sight from the perspective of the Sun to Δ_{pr} = sin (68.7°) x 8588 = 8001 km.

For the last paragraph of p. 139, column 2
Given Mercury's angle of parallax p_M = 19.75" which we derived from its shift *p* with respect to the photosphere at the UTC . . . the images were used and the projected distance between BBSO and Weiden we can now calculate, first, the distance of Earth from the Mercury at that date and time (Fig. 7) and, second, its distance from the Sun. Equally, it is possible to derive the distance between Earth and Sun from the parallactic angle p_S = 10.89" directly. The result is a value of 151.5 million km to the photosphere, or ~151.9 km to the solar center.

Different from the angle of parallax p_S, which depends on the both locations of observation, the solar parallax π_S is defined . . . *2]. We can easily calculate by dividing p_S by the portion between our baseline and the Earth's radius. In this way we get π_S = 8.68 arcseconds.

For the third full paragraph on column 1 of p. 140, note that for Prof. Backhaus's calculation, the value is therefore (151.9-151.1) million km = 0.8 million km, or about 0.5% from the known value.