The Peculiarities of the SEI 105 System

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Abstract: As described in the previous article, measurement of SEI 105 in the constellation Auriga took place on 12 April 2007. The only measures of this system are from 1895 with parameters of 16.8" and 354 degrees. The present article was written because due to the significant proper motion of the primary star, the angular distance of the main pair has changed, and also because a third member has been measured in our own photos (Figure 1), which has caused no little surprise during its thorough examination.

The primary star of SEI 105 – due to its brightness of 6.5 magnitude – has the code HIP 24332 in the Hipparcos Catalog, the database to be mentioned first, henceforth. This F3 star is 85 light-years away and its luminosity is 1.4 times that of the Sun. The proper motion is -145 mas/year in right ascension, -135 in declination. The GSC number of its companion discovered by Scheiner is 2401 329, and its magnitude is 11.3. Before we start analyzing SEI 105, let us say a few words about the two nearby stars that can be found in the Guide (ver. 7) (Figure 2).

The origin of the star numbered as GSC 2401 1313, with brightness of 11.5 cannot be defined precisely. It can be found as 280571 in the Henry Draper Catalog – a star list almost 100 years old, which is still in use partly because of the spectral classifications it contains. In the course of time, it must have been taken over from this database, so it appears in both USNO ACT and A2.0 catalogs, but it cannot be seen in our own photos. By its position, it would fall exactly on the rim of the main star's Airy disc in Schmidt's 1954 image, taken at Mount Palomar, but we found no sign indicating this in the digitized picture.

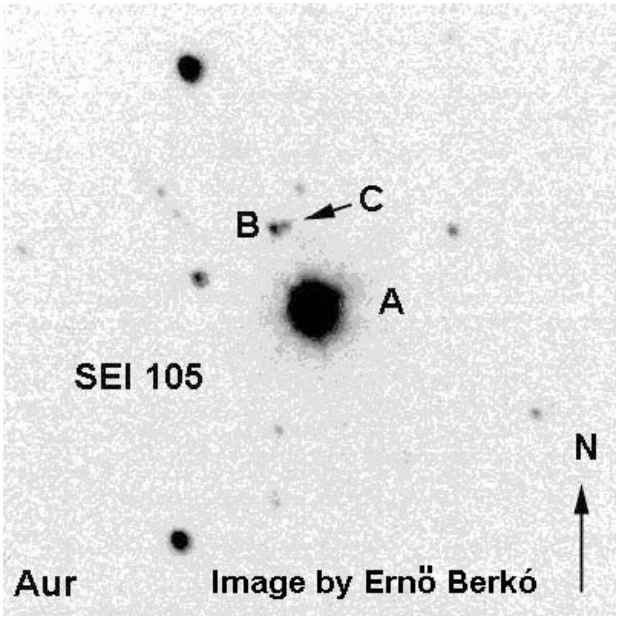

Figure 1: DSLR image of SEI 105.

Even more mysterious is the detectability of GSC 2401 983 (magnitude 13.9) a non-star object, due to

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Figure 2: The region of SEI 105 according to Guide, v7.

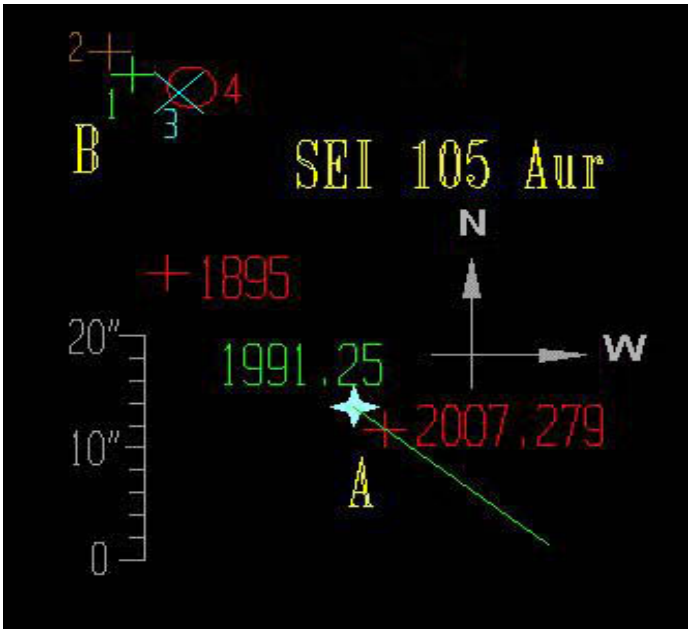

Figure 3: Measured positions of the B component. See text.

the bright star in the vicinity. In our images, the brightness of the star found at the same declination as B-C pair, to the right – that is to the west of it – is 15.4m (B) and 14.9m (R) in A2.0, so it is understandable that it did not get into the GSC. After this, we can continue with the old and new components of SEI 105.

The position of component B, measured by Scheiner, is the following according to the different sources (Figure 3): 1 (green color) is GSC, 2 (brown) stands for the Tycho catalogs (we'll talk about USNO-A2.0 later). The red circle marked 4 and the blue "X", marked 3, indicate the position related to the primary star as measured by Scheiner and Ernő Berkó: it is surprising that these two positions are much closer to each other than the astrometrical coordinates, and it also makes it likely that component B has no significant proper motion.

Due to the primary star's proper motion, the parameters of A-B pair at 2007.279 are: PA = 27.32°, sep. = 34.01". It can be seen that the angular distance has doubled in the past 112 years, and the position angle has increased 33 degrees.

While measuring the images, it was immediately obvious that component B has another close companion, at 4.4" distance and 288 degrees position angle. In order to check this, we downloaded the DSS images: the first original plate (Figure 4) was created on 29.11.1954, and the second (Figure 5) on 23.10.1993. at Palomar Observatory.

The difference between the two images is easily visible, it is obvious that BC pair is changing, too. At the same time, with the help of the diffraction spikes, it can be clearly seen how the main star has changed its position in relation to its surroundings in the past 39 years.

How can we define the movement of BC members numerically? Unfortunately, as could be expected, there are no exact coordinates available for the different epochs of such relatively faint stars located close to each other; and it is this second fact that is of primary significance. The USNO-A2.0 star catalog, which contains the data of more than 526 million stars and was created by analyzing the discs of POSS1 sky survey

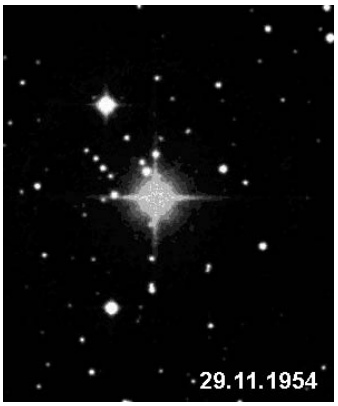

Figure 4: DSS image of SEI 105 taken in 1954.

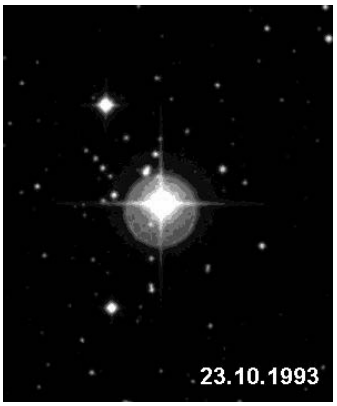

Figure 5: Palomar image of SEI 105 taken in 1993.

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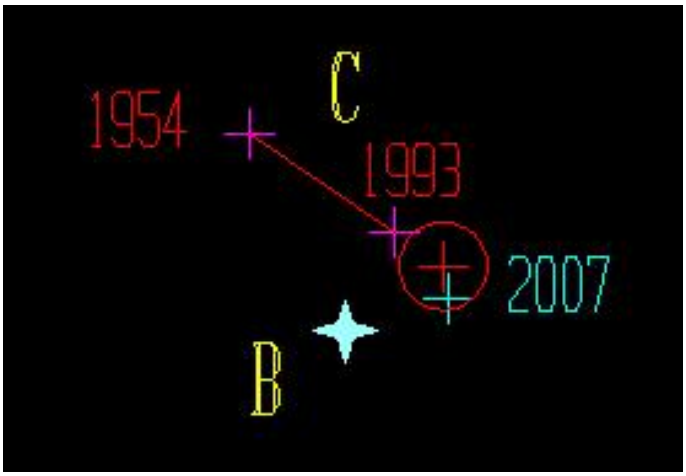

Figure 6: Estimate of the relative positions of the B and C components for 1954 and 1993.

(where Figure 4 originates), gives the coordinates of the center of BC pair's common Airy discs as 1200-03012567. We found this by using a software called "fv", developed for images in FITS format. With the same program, it was necessary to estimate the relative position of B and C components for 1954 and 1993: the results can be found in Figure 6.

The position taken by component B in the two different times is the same within the resolution of the digital images, in C's case the difference is 5-6 pixels. This is -152 mas/year proper motion in right ascension and -104 mas/year in declination with ±5-10% accuracy according to our estimates. The similarity to the primary star's proper motion is striking – taking the factor of inaccuracy into consideration, we could say it is the same. A circle of about 1.8" radius marks the position of member C, extrapolated to 2007 by the proper motion: we can see that measuring our own photos indicates smaller difference. If we calculate C's position for 1895, we get 19" as its distance from B, which could explain why Scheiner did not take it into consideration.

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