

Part 2

Pulkovo today

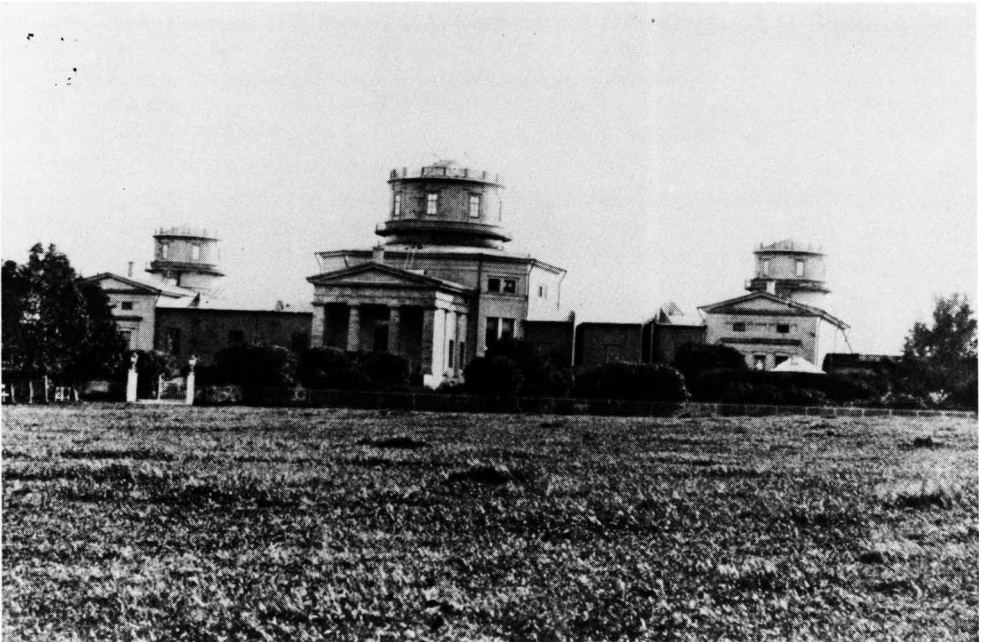


Plate IV. The original Pulkovo Observatory viewed from the north. Photograph provided by Pulkovo Observatory.



Plate V. The reconstructed Pulkovo Observatory viewed from the north. Photograph provided by Pulkovo Observatory.

THE PULKOVO PROGRAMME FOR THE STUDY OF VISUAL DOUBLE STARS

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The observation of visual double stars at Pulkovo is a traditional work of Pulkovo astronomers started by W. Struve in 1830 at Dorpat (now Tartu). After the Second World War and restoration of the observatory in 1960, the observations of double stars have been carried out with help of 26-inch Zeiss refractor using the photographic technique. We observe the visual binaries which satisfy the conditions of highest accuracy of astrometric reduction: $d > 3''$, $m < 12.0$, $dm < 1.0$, $\delta > 20^\circ$.

Annually we obtain about 400-500 plates with photographs of 100-200 binaries. Each plate contains 10-20 images of the binary. Each binary, being observed during 10-20 years, is provided by close set of accurate relative positions of the components. Then we compute the highly accurate apparent motion parameters (AMP), which form the basic data for further investigations.

The mean square errors of AMP values, as obtained by statistical adjustment are as follows: $\pm(0''.003 \text{ to } 0''.010)$ for the relative positions of components and $\pm(0''.0003 \text{ to } 0''.0020)$ for the relative annual motion of components.

The scientific goal of this programme is to find out kinematical and dynamical characteristics of visual double and multiple stars directly from observations. In the course of these investigations we determine the trigonometric and dynamic parallaxes, the orbit elements and the masses of some binaries within 50 parsecs from the Sun. Also we inspect a great number of known but forgotten (i.e., not observed for a long time) binaries, and among them we discover some new nearby stars and then we analyse the perturbations caused by dark companion of the multiple systems.

The Pulkovo AMP-method [1] serves as the theoretical foundation of the programme. This method provide the determination of orbit elements of a visual double star with long period on the basis of short arc observations. The AMP-method is effective, if the positional observation are aided by spectral ones in order to determine radial velocities of components. An appropriate programme of observations is carried out at the Special Astrophysical Observatory (Caucasus) with help of the 6-meter telescope.

The main results of the fulfillment of the Pulkovo double stars programme are presented by the catalogue of relative positions and relative motions of 200 visual double stars [2]. The catalogue contains also the new estimations of dynamical parallaxes for 50 binaries. Among them there are 11 binaries within 25 parsecs of the Sun, which are not included in Woolley's catalogue. The data of the Pulkovo catalogue were used for computing new orbits (by the AMP-method) for 9 visual double stars [1,3], three of them being determined for the first time.

The preliminary elements of these binaries are presented in Table 1.

Table 1.

ADS	Obsr. time	a	P	e	i	Ω	ω	T	π	M	dV
	1900+	["]	[y]		[°]	[°]	[°]	[y]	["]		[km/s]
2427	71–87	8.1	1250	0.42	62	358	21	2100	0.070	1.0	+3.3
8002	70–88	4.2	400	.64	42	351	283	1770	.077	1.0	–0.5
12169	61–83	12.9	3800	.44	124	65	323	2400	.042	2.0	–0.6

The data of the last columns represent the adopted values of the trigonometric parallaxes (π), the sum of the masses of components M (in the units of solar mass) and the relative radial velocities dV , which correspond with the orbit elements.

Also, the perturbations in apparent motion of the stars ADS 11632 and 5983 (δ Gem) were investigated. The detected waves made it possible to suppose the existence of a dark companion with mass 0.006 that of the Sun, belonging to the first binary mentioned, and the existence of a stellar-like component with mass about 0.2 that of the Sun, belonging to δ Gem [4].

Finally, the authors call attention of astronomers to the real problem of determination high accuracy radial velocities of components of double stars in the solar neighbourhood.

References

1. Kisselev, A.A., Kiyeva, O.V.: 1980, *Astr. J. USSR*, **57**, 6, 1227–1241.
2. Kisselev, A.A., Kalinichenko, O.A., *et al.*: 1988, *Catalogue of relative positions and relative motion of 200 visual double stars*, Leningrad, "Nauka", 1–40.
3. Kisselev, A.A., Kiyeva, O.V.: 1988, *Astrophys. and Space Science*, **142**, 181–183.
4. Shakht, N.A.: 1988, *Izv. GAO (Pulkovo)*, #205, pp.5–14.