

28 септември 2019г.

7. **Antennae GMRT.** A table with coordinates of the GMRT antennae as relative positions from the central antenna A14 is given below. The latitude and longitude of A14 are $\varphi = 19^\circ 05' 36''$, $\lambda = 74^\circ 03' 01''$.

- 7.1. Prepare the map of the GMRT antennae system. You need to mark the central square on the map (the $1 \text{ km} \times 1 \text{ km}$ area, which you saw during your GMRT visit), mark antenna at the origin and plot all the antennae outside the central square. Write down the antenna number near its location on the graph paper.

Parallel beams of radio-waves come from distant objects and falls on the GMRT antenna. The signals will reach different antennas at slightly different times depending on the inclination of the source with respect to the Antenna. Let us assume that the four antennae listed below are observing Sun at noon 23rd September: A1, A10, A14, A30.

- 7.2. Calculate the delay in signal arrival between A1 and the Antenna farthest from A1, assuming a flat Earth.

- 7.3. Assuming now the Earth is not flat, calculate the additional term in time lag due to curvature of the Earth.

	x	y	z
Number of Antenna	(to the East) (m)	(to the North) (m)	(to zenith) (m)
Номер антенны	(на восток) (м)	(на север) (м)	(в зенит) (м)
A01	-11245.6	9405.97	-802.858
A02	-8103.19	8241.44	-711.116
A03	-7039.01	5340.29	-411.950
A04	12073.2	4791.68	-389.911
A05	10199.8	3529.75	-324.311
A06	7780.52	3071.49	-266.059
A07	-5199.93	3054.46	-242.446
A08	4575.99	2047.70	-203.543
A09	-3099.40	1496.91	-90.1932
A10	2814.54	1012.49	-73.9663
A11	-1591.91	625.657	-15.1934
A12	-565.940	132.944	-9.99081
A13	-372.720	142.908	-7.13641
A14	0.00000	0.00000	0.00000
A15	67.8200	-257.968	22.0312
A16	-31.4400	-230.489	24.4676
A17	326.430	-39.7862	32.7314
A18	687.870	-18.0767	37.1877
A19	280.670	-419.343	38.2252
A20	41.9400	-156.320	40.3858
A21	-164.860	-615.653	51.1638
A22	174.850	-666.922	53.1313
A23	-603.940	-333.732	56.0502
A24	-474.670	-658.490	70.3163
A25	-639.500	-1171.08	119.326
A26	633.920	-2948.73	258.251
A27	-367.080	-4503.71	371.735
A28	333.120	-6742.06	581.014
A29	947.470	-9458.39	782.898
A30	-369.050	-14097.4	1202.39

3. **Polar day and night.** Find the boundaries of the region of the polar day and the region of polar night at the dates when the Sun may be in Zenith in Mumbai, HBCSE. The latitude and longitude of HBCSE are $\lambda_c = 72^\circ 56'$, $\varphi_c = 19^\circ 03'$. Take as many effects as possible into account.