FROM TEACHERS FOR TEACHERS

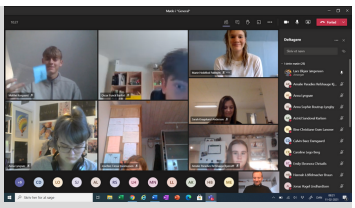
JOINT PROJECTS

projects developed in cooperation between teachers from different countries, one of whom at least participated in a previous Science on Stage festival

FROM COPENHAGEN TO PRAGUE

The goal of the project is to determine the distance between Copenhagen and Prague using astronomical measurements of latitude and relative longitude between the cities. We present a basic method to make the essential latitude and longitude measurements but also other optional historical measuring techniques. Note that the longitude measurement has to be caried out simultaneously in Copenhagen and Prague during the daytime hours. Note also that this method can be applied to any two cities around the world.
The project is inspired by the astronomer Thyco Brahe who was born in Denmark and died in Prague.

Project participants:
From Czech Republic teacher Vera Koudelkova, secondary school ZŠ gen. Fr. Fajtla DFC, Prague -18 with pupils aged 12-14.
From Denmark teacher Lars Elkjær Jørgensen, secondary school Allerød Gymnasium with pupils aged 16-18

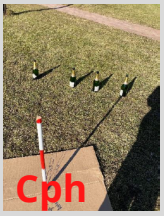


Measuring latitude

The geographical latitude is equal to the height of the north star. This can be understood using a simple geometrical argument. Carefull measurement of the north star with a clinometer wil determine the height with a ±1° accuracy

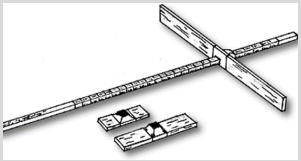
Measuring longitude

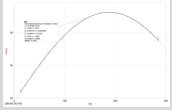
A measurement of true noon with a sundial **on the same day** will determine the difference in geometrical longitude between the two cities



Historical measuring techniques

Instead of a clinometer, you can measure the height of the north star with a cross-staff like Thyco Brahe did. Accuracy will be less than ±1°. Time of day for the sundial experiment can be meassured with an hourglass or a pendulum.,...





Results

The great circle formula

$$dist(A,B) = R \cdot arccos\,(sin(\varphi_A) \cdot sin(\varphi_B) + cos(\varphi_A) \cdot cos(\varphi_B) \cdot cos(\theta_A - \theta_B))$$

Where φ_A is the latitude of point A, φ_B is the latitude of point B, $R = 6378.245\ km$ is the earth mean radius and $\theta_A - \theta_B$ is the difference in longitude angles.

In the theory of the latitude and longitude system, the distance is calculated with the great circle formula. The calculation is easily made using an onlibe calculator like Cactus2000.
The true distance from Copenhagen to Prague is 635 km.