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Expert report about the Ph.D. Thesis of Petra Hyklová: *Research and education at astronomical institutes of the Czech and German universities in Prague in years 1882–1945*

The Ph.D. thesis provides an excellent overview of the development of astronomy in Czechoslovakia, especially of the astronomical institutes / observatories of the Czech and German universities in Prague; particularly the biographies of astronomers and the instruments of the observatories are presented in detail.

Petra Hyklová discusses very good in the introduction the general development of astronomy in the 19th/20th century, especially the transition of classical astronomy to modern astrophysics in the second half of the 19th century. Astrometry was modernised by the introduction of the meridian circle in the beginning of the 19th century. Larger telescopes allowed the observation of fainter stars, which are compiled in star catalogues like *Bonner Durchmusterung*, the AGK-catalogues or the *Carte du Ciel*. The new topics of astrophysics were astrophotography, spectroscopy, and photometry. The Great Debate (1920) and Edwin Hubble's activities in the 1920s changed our world view completely. Based on celestial mechanics (three-body problem), many new asteroids were discovered, starting with Ceres (1800/01), and later with new planets (Neptun, 1846). Then the paradigm shift in the beginning of the 20th century is well explained, leading to Einstein's general theory of relativity (1915), and different solutions of the field equations. The important field of variable stars is mentioned with Argelander and Pickering – in connection with photometry (visual, photographic, and later photoelectric), starting with Zöllner. Finally the organisation of the astronomical community is presented with the first societies and journals.

Very interesting is the discussion of the situation at the *Universitas Carolino-Ferdinanda* with the Czech national revival and the German minority – until the university was split in 1882 into two independent equal university colleges named *k.k. böhmische Karls-Ferdinands-Universität* (Czech university) and *k.k. Deutsche Karls-Ferdinands-Universität* (German university).

In chapter 2 *Astronomy*, Petra Hyklová explains well the complicated history of the two astronomical institutions. The university observatory *Clementinum* passed to the German

university with Ladislaus [László] Weinek (1848–1913) as director, a pioneer of astrophotography. The Clementinum allowed only routine observations, especially timekeeping, terrestrial magnetism and meteorology. The astronomers had to concentrate on theoretical astronomy, for lack of modern instruments for research. For the Czech university August Seydler (1849–1891) established the new department “Astronomical Institute” in a villa at Letná (1889). The development of astronomy in the German and Czech university is presented in the following. With the founding of the Czechoslovak Republic (1918), the German university lost the State Observatory. In 1925, the chair of astronomy at the Czech University was again divided into theoretical (Vladimír Václav Heinrich) and practical (František Nušl). In addition, the *Institut für kosmische Physik* (Institute for Space Physics), Liliová Street 16, was founded in 1908 with Rudolf Spitaler as first director. In Spitaler’s time, research was focused on climatology, after 1929, on geophysics. Very interesting is the activity of the next professor Leo Wenzel Pollak (1888–1964), introduced the new punch cards system of Herman Hollerith (1860–1929) for processing meteorological data, a network in the Czechoslovak Republic.¹

In chapter 3 *Studies*, Petra Hyklová describes her extensive work with counting the astronomy students of both universities from 1882 to 1939, and how many passed the state teacher qualification exams, the doctoral state exams or both exams.

In chapter 4 *Institutional Conditions*, the State Institute k.k. Sternwarte, Astronomical Tower *Clementinum*, is discussed; it was not a very suitable place for astronomical observation in the middle of a city with light and air pollution. In 1882, the astronomical institute was transferred to the German Charles-Ferdinand University; the interesting dispute over the State Observatory is shown. In 1920, the Czech Charles-Ferdinand University (Universitas Carolo-Ferdinandea Pragensis) was renamed back to Charles University; and the State Observatory had to be officially handed over on 19 November 1918 from Adalbert Prey to František Nušl of the Czech university. For the German Charles-Ferdinand University the name *Deutsche Universität zu Prag* was used during the First Czechoslovak Republic (1918–1938); the German university was considered as a new one. The important timekeeping function was continued. Instead of waving a flag from the gallery of the tower, the telephone was used, in addition from 1891 to 1926, a “noon shot”. Then in the 1920s, radio signals were introduced – accurate to tenths of a second. Since 1926, the time signal was also broadcasted.

In chapter 5 *Language and textbooks*, Petra Hyklová describes the difficult process to introduce the Czech language and nomenclature for lectures, Czech textbooks had to be written, the first physics textbook appeared already in 1865-66, before the splitting of the university. August Seydler published the first volume on theoretical physics and theoretical astronomy in 1880. It is an extensive work to invent Czech expressions for physical and astronomical concepts, which is especially important for popularisation. Very interesting, that there are medieval Bohemian planet names, but a new terminology had to be found for the new discovered planets and asteroids.

In chapter 6 *Communities and outreach*, first the legal basis was discussed to create an association. It is interesting that women were mostly admitted only after the turn of the century.

¹An article about Pollak and Hollerith was written by an historian of meteorology for my book *Vom Abakus zum Computer, part 2*, not yet published.

In the following, Petra Hyklová presents examples for astronomical associations, e.g. *Lotos* (1848), *Section for astronomy and physics of Prague German universities* (1909). Private observatories offered assistant positions but they normally existed only a short time until the owner died like Baron John Parish in Žamberk (1841 to 1859). After the *Czech Astronomical Society* (České astronomická společnost, CAS) was founded in 1917, reports about activities of private observatories were published in the journal *Říše hvězd* (Das Reich der Sterne, Realm of the Stars, 1920). After the death of professor Vojtěch Šafařík, his widow donated the instruments of his private observatory to the Frič brothers, who had a workshop for precision mechanics near the university, and built an observatory in Ondřejov (1898–1925), 35 km southeast of Prague, which finally developed as the official observatory of the Czech university in 1928, when it was donated to the state.

Baron Arthur Kraus (1854–1930) founded the first public observatory in Pardubice (1854–1930) (1895, 1912). Then the Štefánik Public Observatory (1928) was erected on bastion No. 4 on Petřín hill. Astronomical Societies founded observatories in different regions of Czechoslovakia: the *Astronomical Society* in Hradec Králové (ASHK) (1929), and acquired a Zeiss refractor (1930), the *South Bohemian Astronomical Society* (JAS, 1928) built an observatory in České Budějovice in 1934/37 with a 4-inch Merz telescope, a six-inch telescope, and a 30-cm-Cassegrain telescope, which was after WWII the second-largest mirror in Czechoslovakia. German societies also started building observatories: the *Vereinigung zur Verbreitung astronomischer Kenntnisse* in Děčín / Tetschen an der Elbe (1920) was the centre of German amateur astronomy in Bohemia and Moravia, and the *Vereinigung der Freunde der Sternwarte der deutschen Universität* (mid 1920s) erected the observatory in Telnice / Telnitz in the Ore Mountains (Krušné Hory), for the German University, between 1924 and 1930. Finally, Petra Hyklová compared the situation with the international development of scientific societies, starting with the *International Union for Cooperation in Solar Research* (1905), and the *International Astronomical Union* (IAU, 1919) – in comparison to the *Astronomische Gesellschaft* (AG).

In chapter 7 *Legacy*, the tensions and the problematic situation in the German university in the Nazi time is discussed. Then the post-war developments with the investigation by the cleansing commission and then with the rising of Czech astronomy is presented.

In chapter 8 *Instruments*, Petra Hyklová presents her comprehensive study of instruments, used in astronomical research, but also in geodesy. This is very detailed, not only a description of the instrument is given, but also changes or repairs, which were made; it is mentioned, if an instrument was transported to another observatory, also highlights of scientific output are emphasized (like the photograph of the Eros opposition in 1930), and finally references. The photos of instruments were found in the different observatories, but also prints in *Říše hvězd*, and written sources.

The alphabetical order is not very helpful for finding an instrument, sometimes the instrument starts with the name of the instrument maker like Clark, Cooke, Steinheil or Zeiss, or with the astronomer who used it (like Šafařík's 8-inch) or who bought it like Gruss telescope or with the observatory name like Petřín comet seeker or finally with the instrument name like Circumzenithal. There are two possibilities for sorting: according to the kind of instrument: Telescopes (refractor, reflector, astrograph, comet seeker), astrometric and geodetic instruments (meridian circle, transit instrument, universal instrument, zenith telescope, circumzenithal), astrophysical instruments (spectroscopes/-graphs, wedge photometer, cameras, solar physics instruments like spectrohelioscope) – laboratory instruments (like coordinate measuring machine, blink comparator, spectrocomparator, iris-diaphragm

photometer) are missing? The other possibility for convenient use is to present the instruments of each observatory like Ondřejov, Stará Ďála, Telnice or the private observatories.

In chapter 9 *Astronomers*, Petra Hyklová presents an extensive valuable compilation of 66 astronomers with relationship to Prague and Czechoslovakia. The biographies are very carefully researched from the sources: education, PhD, the different appointments (like teacher, assistant, adjunct or extraordinary/full professor), the scientific activities, topics of studies and highlights of discoveries, important publications, memberships in scientific societies, honours and awards, references. In addition, it would be nice, to have a table with an overview of all the directors with the adjuncts and assistants of the Clementinum / Charles University and the later institutions.

Summary

Petra Hyklová has written an important and innovative contribution about the development of astronomy in Prague, research and education at the astronomical institutes of the Czech and German universities in the years 1882–1945, embedded in the political and social context.

This PhD thesis is a comprehensive work, clearly structured. Her dissertation is based on accurate and careful research of primary sources in the archives. In addition, her extensive bibliography of secondary literature shows that she has thoroughly studied the subject and consulted all relevant information.

With her dissertation, she has demonstrated excellently that she is capable of in-depth scientific work. I therefore propose to the doctoral committee to accept the PhD thesis of Petra Hyklová and to grade it with very good (*magna cum laude*).

Sincerely

Prof. Dr. Gudrun Wolfschmidt