Astronomy and Astrophysics in the Gaia sky
Proceedings IAU Symposium No. 330, 2017
A. Recio-Blanco, P. de Laverny, A.G.A. Brown & T. Prusti, eds.

doi:10.1017/S1743921317005336

GIER: A Danish computer from 1961 with a role in the modern revolution of astronomy - II

Erik Høg

Niels Bohr Institute, University of Copenhagen,
DK-2100, Copenhagen Ø, Denmark
email: ehoeg@hotmail.dk

Abstract. A Danish computer, GIER, from 1961 played a vital role in the development of a new method for astrometric measurement. This method, photon counting astrometry, ultimately led to two satellites with a significant role in the modern revolution of astronomy. A GIER was installed at the Hamburg Observatory in 1964 where it was used to implement the entirely new method for the measurement of stellar positions by means of a meridian circle, at that time the fundamental instrument of astrometry. An expedition to Perth in Western Australia with the instrument and the computer was a success. This method was also implemented in space in the first ever astrometric satellite Hipparcos launched by ESA in 1989. The Hipparcos results published in 1997 revolutionized astrometry with an impact in all branches of astronomy from the solar system and stellar structure to cosmic distances and the dynamics of the Milky Way. In turn, the results paved the way for a successor, the one million times more powerful Gaia astrometry satellite launched by ESA in 2013. Preparations for a Gaia successor in twenty years are making progress.

Keywords. history of astronomy, stars: distances, Galaxy: kinematics and dynamics, dark matter, solar system: general

---

The following on the poster is a short version of the article by Høg (2017, hereafter EH2017) where further references are given.

1. A new astrometric method

The meridian circle was the fundamental astronomical instrument for measuring large angles between stars and thereby establishing an accurate coordinate system on the sky. Naked eye observation of the star was used as it crossed the telescope field of view, but an entirely new method for measuring the star, *photon counting astrometry*, was proposed in 1960 at the Hamburg Observatory by the present author, see Høg (2011 or 2017). The method was implemented on the Hamburg meridian circle and proved to be a success on the Hamburg expedition to Perth in Western Australia during the five years 1967-72.

The method was also well received by astronomers elsewhere, especially in France where the grid with inclined slits required for the method was called "une grille de Høg" in those years. Most significant was that Pierre Lacroute (1906-1993), director of Strasbourg Observatory, adopted the method for his great vision of astrometry from space, Lacroute (1967, 1974 - see references in EH2017).

In 1975 ESA began a study of these ideas to which I was invited and soon proposed a mission design with many new features, see Høg (2011). The resulting Hipparcos satellite mission was launched in 1989 and the astrometric results obtained by photon counting astrometry were published in 1997. A new era for astrometry had begun where all branches of astrophysics benefitted as explained in the abstract.

Figure 1. GIER computer room of Perth Observatory 1971. GIER, in the teak cupboard in the background at right, was one of the first transistorized computers. Mrs Ilse Holst at the reader for 8-channel punched tape, one roll could contain 120 kilobytes. The control panel is seen just behind the paper punch. The tape from reader or punch poured into a large basket and could then be quickly rolled up. The operator would type commands to start a program on the typewriter and e.g. error messages from the computer were typed on endless paper. - Photo: Bernd Loibl.

2. Peter Naur and the Danish computer from 1961

Peter Naur (1928-2016) played important roles in this development as detailed in EH2017. He was my tutor at Copenhagen University from September 1953 and introduced me to astrometry, electronics and computing, subjects not common in astronomical department in those years when astrophysics had become fashionable.

Naur himself had been an astronomer when he was a school boy. He worked in astrophysics on stellar evolution and in astrometry, e.g., at the new meridian circle installed at Brorfelde in 1953. But he was far from satisfied with the observatory leadership and left astronomy entirely. In 1959 Naur joined Regnecentralen, a new public institution where a new computer, GIER, was being developed, one of the first transistorised ones. He was leading in the development of the ALGOL programming language. He won the 2005 Turing-award, "the Nobel-prize of computer science".

In 1964 a GIER computer with a powerful ALGOL60 compiler was acquired for the Perth expedition because it was ten times faster than the fastest other affordable computer, the IBM1620, and GIER was 20 percent cheaper. The speed was crucial for the expedition since it was just about possible to keep pace with the many observations produced at the meridian circle in Perth. Without GIER the pioneering scientific work would have failed - but the success gave confidence in the new astrometric method and I could continue to believe in my ideas.

References

Høg, E. 2017, *GIER: A Danish computer from 1961 with a role in the modern revolution of astronomy*. Nuncius Hamburgensis, Vol. 20, Ed. G. Wolfschmidt. 19 pp, arXiv.1704.05828

Høg, E. 2011, *Astrometry Lost and Regained. Baltic Astronomy*, 20, 221–230. http://esoads.eso.org/abs/2011BaltA..20..221H

https://doi.org/10.1017/S1743921317005336 Published online by Cambridge University Press