



# SSR: Solar System Simulator

Dietmar G. Schrausser

<https://github.com/Schrausser/SSR>

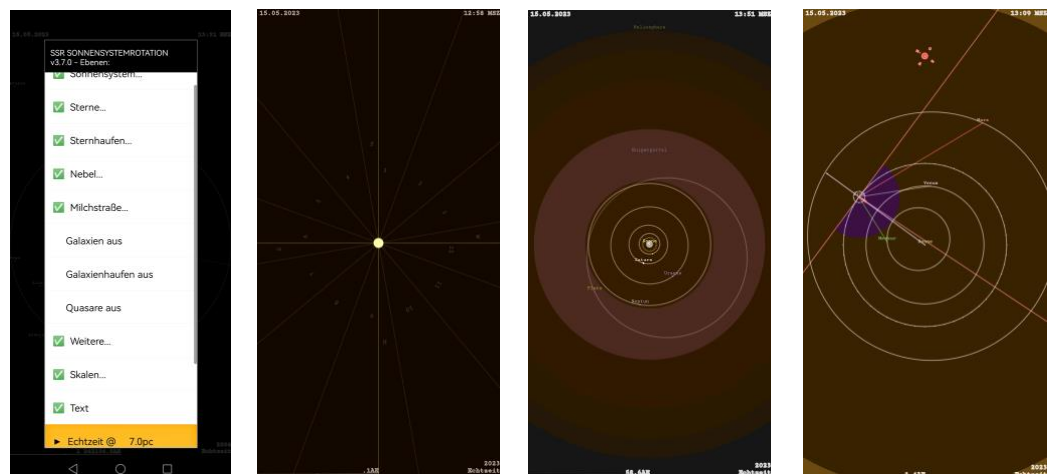
## Overview

Solar System Simulation SSR. Android globus coelestis (celestial globe) and interactive calendar with Zodiac signs and timepiece covering the Solar System in the entire observable Universe up to  $r = 14.25 \text{ Gpc}$ .

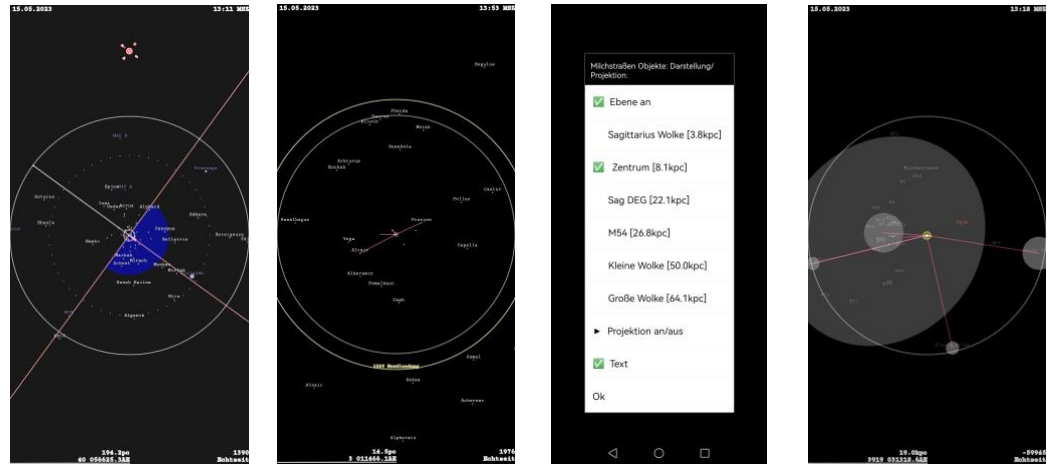
Contains  $n = 69$  stars,  $n = 70$  nebulae and star clusters, most important Milky Way objects,  $n = 48$  galaxies and galaxy clusters as well as the most well-known quasars. Full implementation of all  $n = 110$  Messier objects (Messier, 1784), Inner Cloud (Hills, 1981), Oort Cloud (Oort, 1950) and more.

Further astronomical objects can be implemented by means of external definition files. All objects of the Caldwell Catalogue (Moore & Pepin, 1995) are included as *ssr\_Caldwell.dat*. For additional important astronomical catalogues see e.g. CN (Herschel, 1786) or NGC (Dreyer, 1888).

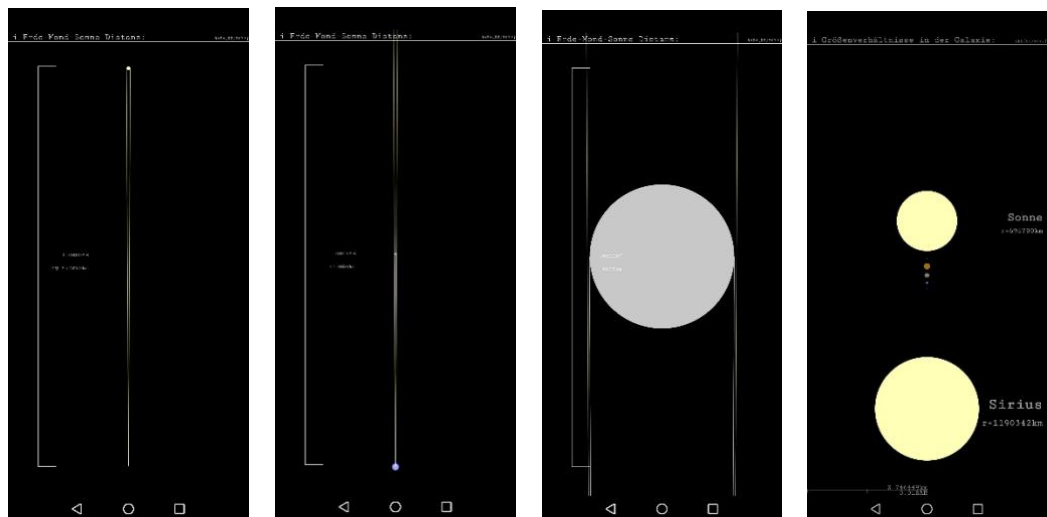
Solar System parameters of the Sun, planets and Moon are based on the current NASA Planetary Fact Sheets (Williams, 2023). Positions, distances and sizes of further objects are from Wikipedia sources (Wikipedia contributors, 2023), which can be traced back primarily to the SIMBAD astronomical database (Strasbourg astronomical Data Center, 2023), the Vizier Catalogue Service (see Ochsenbein et al., 2000) or the NASA/IPAC Extragalactic Database NED.



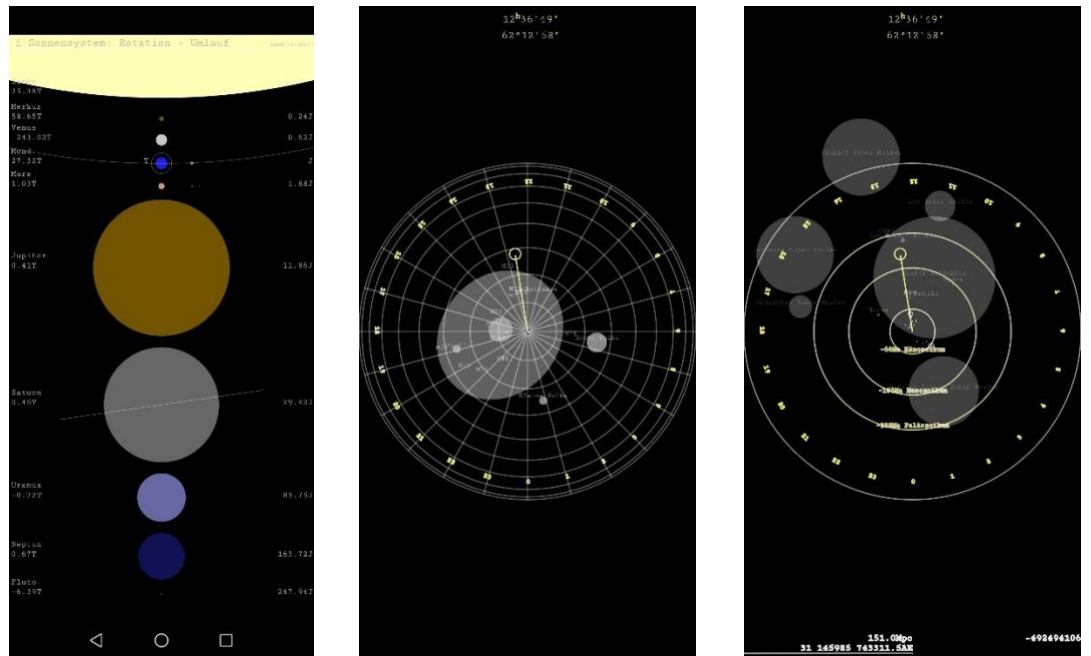
**Figure 1:** The Sun at  $r = 0.1 \text{ au}$  astronomical units; Solar System with Asteroid and Kuiper Belts as well as Heliosphere at  $r = 58.6 \text{ au}$ ; Inner Solar System with orbits, current rotation position of the Earth with time and position representation, as well as projection lines to the neighboring planets at  $r = 1.4 \text{ au}$ .



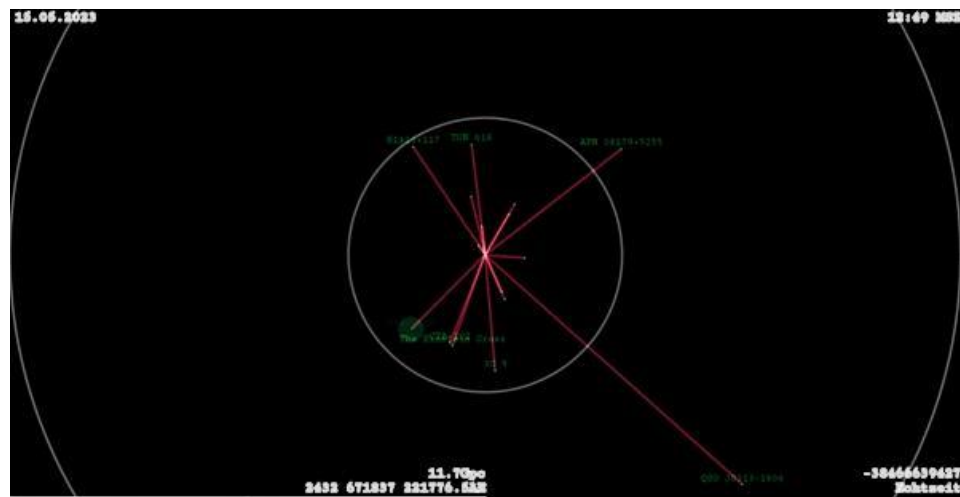
**Figure 2:** Surrounding stars at  $r = 194.2 \text{ pc}$  and their relative positions to Earth, artificial horizon facing south; closer stars with their relative historical position and representation, from  $r = 14.5 \text{ pc}$  before the year 1976; the Milky Way at  $r = 19 \text{ kpc}$  with Magellanic Clouds, Sagittarius Dwarf Elliptical Galaxy Sag DEG (Ibata et al., 1994) and V838 Monocerotis (Brown et al., 2002).



**Figure 3:** Interactive simulation to display distances between Earth, Moon and Sun with corresponding perspective projection lines; interactive simulation to compare sizes of stars.



**Figure 4:** Parameters of the Solar System; Hubble deep field (HDF) located at a right ascension of  $12^{\text{h}} 36^{\text{m}} 49^{\text{s}}$  and a declination of  $+62^{\circ} 12' 58''$  (see [Ferguson, 1996](#)); towards the HDF from a distance of  $r = 151 \text{ Mpc}$  within the surrounding galaxy clusters and Laniakea supercluster ([Tully et al., 2014](#)) with relative historical positions.



**Figure 5:** Most distant quasars on the edge of the observable Universe at  $r > 9 \text{ Gpc}$  (see e.g. [Wang et al., 2021](#)).



**Figure 6:** Local star cluster within Orion-Cygnus Arm containing the signs of the Zodiac and surrounding nebulae seen from a distance of  $r = 3 \text{ kpc}$ .

## Acknowledgement

This research has made use of the NASA/IPAC Extragalactic Database (NED), which is funded by the National Aeronautics and Space Administration and operated by the California Institute of Technology. <http://ned.ipac.caltech.edu/>

## References

- Brown, N. J., Waagen, E. O., Scovil, C., Nelson, P., Oksanen, A., Solonen, J., & Price, A. (2002). Peculiar variable in Monoceros. *International Astronomical Union Circular*, 7785, 1. <https://ui.adsabs.harvard.edu/abs/2002IAUC.7785....1B>
- Dreyer, J. L. E. (1888). A New General Catalogue of Nebulae and Clusters of Stars, being the Catalogue of the late Sir John F. W. Herschel, Bart., revised, corrected, and enlarged. *Memoirs of the Royal Astronomical Society*, 49, 1—237. <https://ui.adsabs.harvard.edu/abs/1888MmRAS..49....1D>
- Ferguson, H. (1996). *The Hubble Deep Field – field selection*. Space Telescope Science Institute.
- Herschel, W. (1786). Catalogue of One Thousand New Nebulae and Clusters of Stars. *Philosophical Transactions of the Royal Society of London*, 76, 457—499. <https://doi.org/10.1098%2Frstl.1786.0027>
- Hills, J. G. (1981). Comet showers and the steady-state infall of comets from the Oort Cloud. *Astronomical Journal*, 86, 1730—1740. <https://doi.org/10.1086%2F113058>

- Ibata, R. A., Gilmore, G., & Irwin, M. J. (1994). A dwarf satellite galaxy in Sagittarius. *Nature*, 370, 194—196. <https://doi.org/10.1038%2F370194a0>
- Messier, C. (1784). *Catalogue des nébuleuses et amas d'étoiles, La Connaissance des temps, ou connaissance des mouvements célestes, pour l'année bissextile 1784*. Paris, Imprimerie royale, 1781, p. 227—267. <http://www.messier-objects.com>
- Moore, P., & Pepin, M. B. (1995). Beyond Messier: The Caldwell Catalogue. *Sky and Telescope* Vol. 90, Cambridge, MA. <http://www.messier.seds.org/xtra/similar/caldwell.html>
- Ochsenbein, F., Bauer, P., & Marcout, J. (2000). The VizieR database of astronomical catalogues. *Astronomy and Astrophysics Supplement Series*, 143, 23—32. <https://doi.org/10.1051/aas:2000169>
- Oort, J. H. (1950). The Structure of the Cloud of Comets Surrounding the Solar System and a Hypothesis Concerning its Origin. *Bulletin of the Astronomical Institutes of the Netherlands*, 11, 91—110. <https://ui.adsabs.harvard.edu/abs/1950BAN....11...91O/abstract>
- Strasbourg astronomical Data Center. (2023). *SIMBAD, Set of Identifications, Measurements and Bibliography for Astronomical Data*. CDS. STRASBOURG, France. <http://cdsweb.u-strasbg.fr/Simbad.html>
- Tully, R. B., Courtois, H., Hoffman, Y., & Pomarède, D. (2014). The Laniakea supercluster of galaxies. *Nature*, 513, 71—73. <https://doi.org/10.1038/nature13674>
- Wang, F., et al. (2021). A Luminous Quasar at Redshift 7.642. *The Astrophysical Journal*, 907(1), L1. <https://doi.org/10.3847%2F2041-8213%2Fabd8c6>
- Wikipedia contributors. (2023). *Wikipedia, The Free Encyclopedia*. Retrieved May 2023 from <https://www.wikipedia.org>
- Williams, D. R. (2023). *Planetary Fact Sheet*. NASA Goddard Space Flight Center. <https://nssdc.gsfc.nasa.gov/planetary/factsheet/>