

The double star catalogs of the USNO

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Abstract. Since 1964 the US Naval Observatory (USNO) has been charged with maintaining and distributing double star catalogs. Beginning later in 2025 all four of our catalogs will be available online for the first time. These include:

1. The Washington Double Star (WDS) Catalog contains the epochs, position angles, separations, magnitudes, spectral types, proper motions and precise positions of classic double and multiple stars.
2. The WDS Supplement (WDSS) is a database for large duplicity surveys.
3. The Sixth Catalog of Orbits of Visual Binary Stars (ORB6) contains 3,655 orbits of 3,539 systems from a master file database of 10,685 orbits.
4. The Second Catalog of Rectilinear Elements (LIN2) contains 1,288 linear fits for systems whose motions do not appear to be Keplerian.

These last two catalogs are not discussed here.

Key words: binary stars – multiple stars

1. Washington Double Star (WDS) catalog

The Washington Double Star (WDS) Catalog ([Mason et al., 2001](#)) currently consists of 156,861 systems based on 2,216,034 measures. It includes a summary of relative positions, precise position, proper motions, cross reference identifier, spectral types, and notes to other data sets or catalogs. The WDS is successor to the Index Catalog of Double Stars ([Jeffers et al., 1963](#)) which was codified at the Commission 26 (Double & Multiple Stars) meeting at the 1964 International Astronomical Union General Assembly ([van de Kamp, 1966](#)). The summary catalog is available online or as a VizieR overlay and is updated regularly.

While perusal of literature for double star measures from classic techniques has always been fruitful, the WDS has been matched with astrometric catalogs, primarily those used for the determination of proper motion for other astrometric catalogs produced at the USNO. These catalogs have significantly improved the identification of pairs with their precise position such that 97% of them have at least arcsecond-precise positions. Also the proper motion of the secondary is now provided for 38% of all pairs, aiding in the identification of common proper motion binaries and optical doubles. Pairs having common or mutually exclusive parallaxes are also indicated. The average number of measures per system

has increased from 6.7 in 2001 to over 14 measures per system today. Many identified binaries from Gaia DR2 and DR3 have been matched with previously known WDS pairs and added to the catalog.

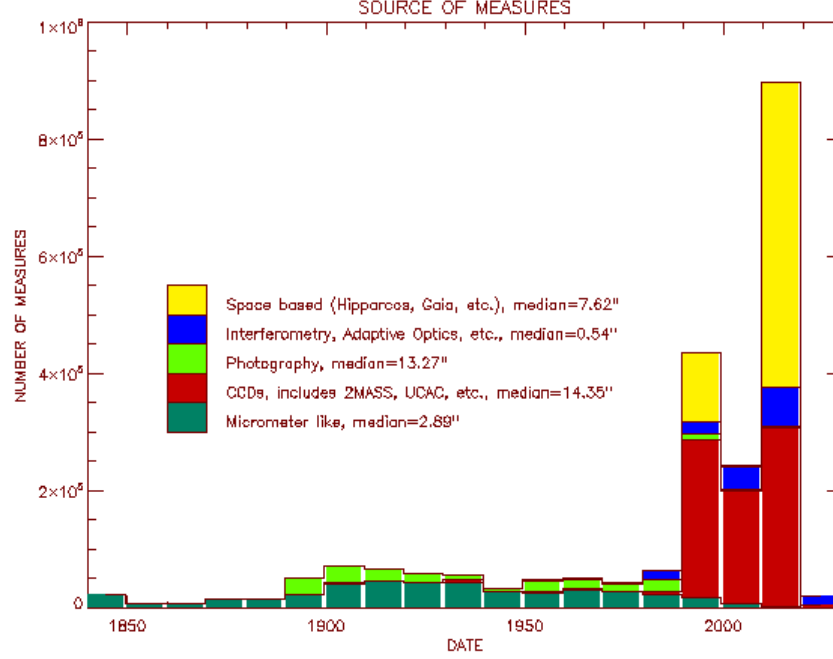


Figure 1. Observation types in WDS vs. time

The source of WDS measures versus time is shown in Figure 1. The median separation of each broad data-type is given as well. The majority of the data classified as CCD is from matching like that described above.

Historically, only the summary version of the WDS was available online with all measures of individual systems delivered on demand. However, we anticipate making the entire measurements database accessible in mid 2025.

2. Washington Double Star Supplemental (WDSS) catalog

With the advent of these new discoveries in the Era of Big Sky Surveys, the historical 10-digit WDS designation was of insufficient precision for the number of new pairs. However, as a Designation it could not be changed. Also, the vast number of these new pairs created difficulties in searching for these well-observed historical pairs. The Washington Double Star Supplemental Catalog (WDSS) is a database created for these large, faint duplicity surveys. It currently consists of 2,428,631 systems based on 11,245,028 measures. The WDSS has

shown significant and rapid growth since the mid 2017 initial release, primarily due to Gaia. Figure 2 indicates the number of measures compared with the WDS: it currently has $5\times$ as many measures and $15\times$ as many systems.

The entire WDSS is available online.

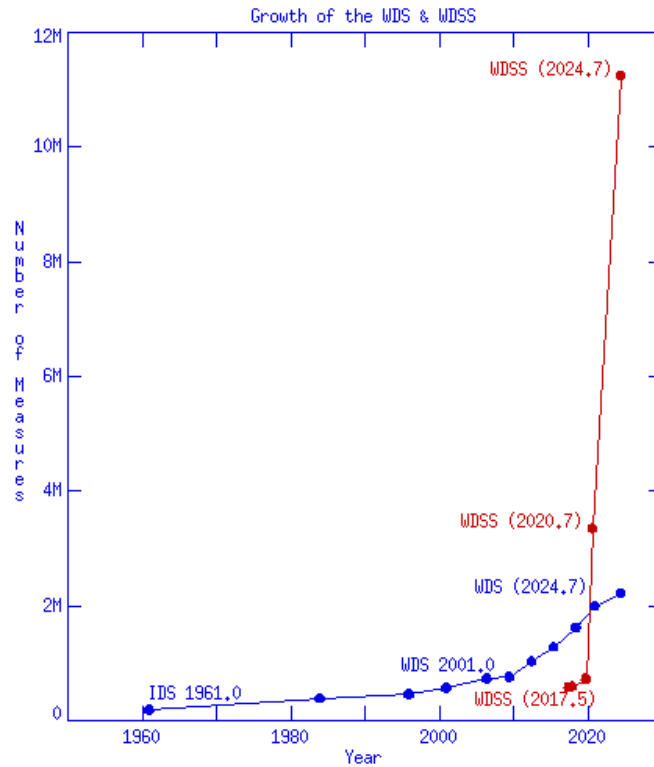


Figure 2. In the plot above the number of WDS measures (blue) is shown with the number of WDSS measures, keyed to the left axis.

References

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