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The Vera C. Rubin Observatory Data Preview 2

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ABSTRACT

We present an early version of Rubin Data Preview 2 (DP2), the second data preview from the National Science Foundation–Department of Energy Vera C. Rubin Observatory. Early Data Preview 2 (EDP2) comprises coadds, detection catalogs, and ancillary data products; eventually, the full DP2 will also include single-epoch images and difference images, but any analysis begun on EDP2 will require no modification. DP2 is derived from observations acquired by the LSST Science Camera (LSSTCam) on the Simonyi Survey Telescope at the Summit Facility on Cerro Pachón, Chile, primarily during the on-sky commissioning campaign between 2025-04-16 and 2025-09-21, supplemented by observations taken between 2025-10-25 and 2026-01-06 that overlap the commissioning footprint. The DP2 footprint comprises the Science Validation wide-area survey, five Deep Drilling Fields, and a number of targeted small-field regions, including Trifid and Lagoon, Prawn, M49, and New Horizons, all observed as part of the Rubin First Look campaign. Each field was imaged in up to six broad photometric bands, *ugrizy*, and coadded to produce deep imaging covering an estimated 3,000 $\deg^2$. The addition of single-visit-only areas expands the total DP2 footprint to an estimated 15,000 $\deg^2$, with coverage in at least one filter. The median per-visit PSF FWHM across the wide-area survey ranges from 1.17 arcsec in the z band to 1.26 arcsec in g and r bands, with the sharpest fields reaching $\sim 0.''0$. COSMOS, the deepest field, reaches estimated coadded 5σ depths of u=26 mag, g=26.8 mag, r=26.3 mag, i=26.1 mag, z=25.3 mag, y=23.9 mag. DP2 contains X distinct astrophysical objects, of which X are extended in at least one band in coadds, and X solar system objects, of which X are new discoveries. DP2 is approximately 59.15 TB in size and is available to Vera C. Rubin Observatory data rights holders via the Rubin Science Platform, a cloud-based environment for the analysis of petascale astronomical data. Based on a roughly five-month primary observing baseline and covering only part of the eventual LSST footprint, DP2's area, depth, and multiband coverage nonetheless support a broad range of early science investigations ahead of LSST Data Release 1.

Keywords: Rubin Observatory - LSST

1. INTRODUCTION

The National Science Foundation (NSF)–Department of Energy (DOE) Vera C. Rubin Observatory is a ground-based, wide-field optical-near-infrared facility on Cerro Pachón in northern Chile, built to carry out the Legacy Survey of Space and Time (LSST) (Ivezić et al. 2019). The observatory is named in honor of Vera C. Rubin, whose observations in the latter half of the 20th century established the first compelling empirical case for dark matter (Rubin & Ford 1970; Rubin et al. 1980).

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Its 10-yr survey will image the entire visible southern sky every 3–4 nights, reaching a coadded depth of $\sim$ 27 mag in the r-band across an 18000 $\deg^2$ footprint (Bianco et al. 2022).

At the heart of the facility is the 3.2 gigapixels-gigapixel LSST Science Camera (LSSTCam), mounted on the 8.4 m (6.5 m effective aperture) Simonyi Survey Telescope (Stalder et al. 2024). Together they deliver an instantaneous field of view of 9.6 $\deg^2$ in six broadband filters, *ugrizy* (320–1050 nm), with seeing-limited image quality. The system's étendue of 319 $\deg^2\,m^2$ exceeds that of any previous optical facility by over an order of magnitude, enabling the rapid, deep, all-sky cadence that underpins Rubin's four core science themes: the nature of dark energy and dark matter; a census of the solar system; the transient and variable optical sky; and the structure of the Milky Way (Ivezić et al. 2019). An automated Data Management System processes tens of terabytes of images per night to produce science-ready data products within minutes of each observation for a global community of scientists.

This paper presents Rubin's third Data Preview, Data Preview 2 (DP2) (NSF-DOE Vera C. Rubin Observatory 2025), and the first to be based entirely on LSSTCam data. It marks the conclusion of the Rubin commissioning program and the transition to full survey operations. DP2 is a reprocessing of all science-grade exposures acquired with LSSTCam during on-sky commissioning and the initial phase of early operations, prior to the formal start of the LSST on 2026-06-29. As such, it represents a natural boundary and provides a comprehensive dataset that captures the on-sky performance of the as-built system at the end of the Rubin construction project.

Two earlier Data Previews preceded DP2 as part of the Rubin Early Science Program (Guy et al. 2026), established to provide the community with early access to data products and services needed to produce high-impact science during the period spanning commissioning through the first Data Release. Data Preview 0 (DP0) was based on simulated LSST-like data (LSST Dark Energy Science Collaboration (LSST DESC) et al. 2021) and served primarily to stand up early versions of the Rubin Science Platform (RSP) and prepare the community for data access at scale. Data Preview 1 (DP1) (NSF-DOE Vera C. Rubin Observatory 2025) delivered the first data products derived from on-sky observations using science-grade exposures acquired with Rubin Commissioning Camera (LSSTComCam) (Stalder et al. 2022, 2020; Howard et al. 2018; SLAC National Accelerator Laboratory & NSF-DOE Vera C. Rubin Observatory 2024); a 144-megapixel, single-raft instrument used during early commissioning prior to the installation of LSSTCam on the Simonyi Survey Telescope. DP2 supersedes both in scope, fidelity, and scientific depth.

DP2 contains X science-grade exposures acquired over 158 nights between 2025-04-16 and 2025-09-21, covering a total sky area of $\sim$15 deg^2 across X fields. The data products include raw and calibrated single-epoch images, coadded images, difference images, source detection catalogs, and a range of derived data products. The release totals approximately 59.15 TB and contains around X distinct astronomical objects. Full release documentation is available at https://dp2.lsst.io.

Because DP2 is drawn from a commissioning and early-operations data rather than from the more uniform and systematic LSST, its images and derived products reflect a system that was still being commissioned and tuned. LSSTCam's greater scale and complexity relative to LSSTComCam introduced systematics with no direct counterpart in DP1. For much of the campaign the Active Optics System (AOS) closed loop converged on a slightly mis-calibrated focus target, imprinting a spatially varying defocus across the focal plane that was only corrected on sky in December 2025 and that remains visible in the point-spread function (PSF) of a large fraction of DP2 exposures. Delivered image quality and PSF ellipticity did not consistently meet LSST design requirements in wide-area survey-mode observations by the close of commissioning; and stray- and scattered-light artifacts, sky-background systematics in crowded fields, and a chromatic PSF dependence[2] were identified and only partially mitigated in DP2 processing. These effects, their diagnosis, and the mitigations applied are described in §2 and §5.

Unlike the systematic, rolling revisit pattern that will characterize the LSST, DP2's observing cadence is opportunistic: fields and filters were prioritized to serve AOS and Science Pipelines commissioning rather than to build a representative time series. The Science Validation survey footprint was repeatedly re-scoped over the course of the science validation campaign due to the competing demands of engineering tests and filter availability, which was constrained by hardware issues for part of the campaign. Visit counts and time sampling therefore vary substantially and idiosyncratically from field to field, and DP2 should not be read as a preview of LSST's eventual survey cadence, revisit statistics, or depth-accumulation pattern.

DP2 is being delivered in two phases across the Jul–Dec 2026 window. The first phase, Early DP2 (EDP2), comprises the deep coadd images and all associated catalogs, including new cell-based coadds and the first releases of the Object Shear (§??) shape-measurement catalog and the Isolated Star Stellar Motions catalog (§??). EDP2 is targeted for 2026-07-27. The second phase, DP2, adds the visit-level single-epoch and difference images, completing the full release, and is expected in the Oct–Dec 2026 range. Data products delivered as EDP2 will be incorporated into DP2 unchanged, without additional reprocessing (Guy et al. 2026). This phased delivery follows directly from Rubin's hybrid cloud architecture (O'Mullane et al. 2024a), in which science data products are stored at the United States Data Facility (USDF) and served to users via the US Data Access Center (DAC) in Google Cloud. Deep coadd images and cat-

[2] LSSTCam has no atmospheric dispersion corrector

alogs are hosted directly in Google Cloud and are therefore unaffected by hybrid-cloud readiness, allowing them to ship as EDP2. Visit-level images, however, must be streamed from the USDF, and the necessary capacity is not yet fully in place, introducing timing uncertainty for the second phase. Delivery of the Prompt Data Products follows the same logic. The Prompt Products DataBase (PPDB), Rubin's real-time catalog of transient, variable, and moving-object detections, does not depend on USDF–Google Cloud bandwidth and is therefore prioritized as the second Early-Operations delivery milestone, following EDP2 and preceding the full DP2 release, expected in the Sep–Oct 2026 range. Prompt images (raw images, Processed Visit Images, and difference images), which do require that bandwidth, have been deprioritized relative to EDP2 and the PPDB and are expected to become available only in the Oct–Dec 2026 range, following both.

DP2, like all Rubin Data Previews and Data Releases, is subject to a 2 yr proprietary period; during this time access is restricted to LSST data rights holders (Blum & the Rubin Operations Team 2020) via the RSP (Jurić et al. 2019), Rubin's cloud-based data science platform (Jurić et al. 2019). After the proprietary period, DP2 will be made public, though access through Rubin DACs in the US and Chile will remain limited to data rights holders (Blum & the Rubin Operations Team 2020). Alternative public access mechanisms have not yet been finalized.

The structure of this paper is as follows. Section 2 describes the observatory system and its status at the close of commissioning, the fields included in DP2, and the observing strategy employed. Section 3 summarizes the data products in the release. The processing pipelines are described in Section 4, followed by data validation and performance characterization in Section 5. Section 6 describes the RSP. Section 7 outlines Rubin's community support model. A summary and outlook toward the start of formal LSST Data Releases is given in Section 8.

All magnitudes are quoted in the AB system (Oke & Gunn 1983) unless otherwise specified.

2. COMMISSIONING WITH LSSTCAM

3. OVERVIEW OF THE CONTENTS OF RUBIN DP2

4. DATA RELEASE PROCESSING

5. PERFORMANCE CHARACTERIZATION AND KNOWN ISSUES

6. RUBIN SCIENCE PLATFORM

The RSP (Jurić et al. 2019) is a powerful, cloud-based environment for scientific research and analysis of peta-scale astronomical survey data and serves as the primary interface for scientists to access, visualize, and conduct next-to-the-data analysis of Rubin and LSST data. Built around a "bring the compute to the data" principle, it eliminates the need for users to download massive datasets, instead providing Rubin data rights holders with secure, single-sign-on access to data and services via three distinct user-facing Aspects: a *Portal*, which facilitate interactive exploration of the data; a JupyterLab-based *Notebook* environment for data analysis using Python; and an extensive set of *API*s that enable programmatic access to both data and services.

The three Aspects are designed to be fully integrated, enabling seamless workflows across the RSP. The RSP is supported by a number of backend services, including databases, files, and batch computing. Support for collaborative work through shared workspaces is also included in the RSP. The data products described in §3 are accessible via all three Aspects, and the system facilitates operations such as starting a query in one Aspect and retrieving its results in another. Figure 1 shows the RSP landing page in the Google cloud.

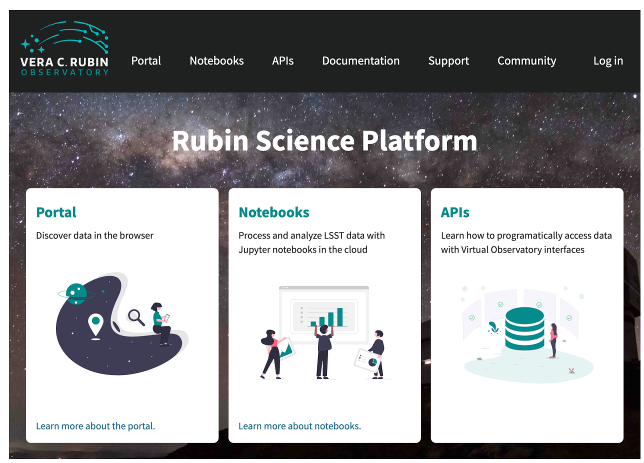

Figure 1. The RSP landing page at https://data.lsst.cloud/ showing the three user-facing Aspects as well as links to documentation and support information.

A preview of the RSP was first launched on Google Cloud in 2022, operating under a shared-risk model to support DP0 (O'Mullane et al. 2024b). DP1 built on that early preview to bring major upgrades including the hybrid on-premises USDF/cloud deployment, a broader set of International Virtual Observatory Alliance (IVOA) API services (SIAv2, SODA cutouts, HiPS, WebDAV, alongside the existing Table Access Protocol (IVOA standard) (TAP)), and a fully integrated, read-only Data Butler (S3 store + AlloyDB registry) across all three RSP Aspects.

The size (3.5 TB) and complexity of DP1 did not, on their own, necessitate the full functionality of the RSP for analysis; a traditional "download the data" model would still have sufficed. However, it was important to provide users the same experience and interfaces they will rely on for later, larger releases, and to get them started in this new paradigm on a small, manageable dataset. DP2, by contrast, marks a new regime, with its size of 59.15 TB outside the range of the traditional download model. The experience users gained working with DP1 through the RSP interfaces can now be applied directly to DP2. The release of DP2 builds on this evolving platform to bring additional upgrades and new functionality, including expanded user query-history and query-status capabilities, context-aware in-application documentation (e.g., contextual help linked directly from Portal table columns), and support for the ADQL spatial `INTERSECTS()` operation.

The RSP remains under active development, with incremental improvements being rolled out as they mature. During the Rubin Early Science Phase, the RSP will continue to operate under a shared-risk model. This section outlines the RSP functionality available at the time of the DP2 release and provides an overview of planned future capabilities.

6.1. *Rubin US Data Access Center*

The Rubin US DAC utilizes a novel hybrid architecture that combines on-premises infrastructure at the USDF at SLAC with flexible, scalable resources in the Google cloud (O'Mullane et al. 2024a). User-facing services are deployed in the cloud to support dynamic scaling in response to user demand and to simplify the provisioning and management of large numbers of science user accounts, whereas the majority of the static data products described in §3 are stored on premises at the USDF, benefiting from cost-effective mass storage and close integration with Rubin's data processing infrastructure, also located at the USDF. For all imaging data except coadds, the Data Butler (§6.2.2) provides the interface between cloud-based users and the on-premises data; for catalog data, a cloud-based TAP client (§6.2.1) submits queries to the on-premises Qserv database cluster (§6.5) and retrieves the results. Deep Coadd images are the exception to this hybrid model: because there is one coadd per sky region per band, a relatively small and size-bounded dataset, they are hosted directly in Google Cloud to benefit from cloud-native access.

DP2 is being delivered in two phases because full end-to-end integration of the hybrid RSP for images was not yet complete by the time data processing (§ **??**) finished; the hybrid model supporting Qserv (§**??**) catalog access over TAP, by contrast, is already in production for EDP2. Rubin therefore adopted a phased release, given that neither coadds nor catalogs depend on the image-side hybrid RSP integration readiness. Early DP2 (EDP2), comprising the deep coadd images and all catalogs, was released on 2026-07-27, while the full DP2 release, adding the visit-level data products once hybrid image integration is demonstrated, is expected in the Oct–Dec 2026 range.

6.2. *Application Programming Interface Aspect*

The Application Programming Interface (API) Aspect provides a comprehensive set of user-facing interfaces for programmatic access to the DP1 data products, through both IVOA-compliant services and the Rubin Data Butler. IVOA services enable standard queries and integration with existing tools, while the Butler facilitates advanced data processing with the LSST Science Pipelines.

Since the DP1 release, additional services have been added as the RSP moves toward full functionality, but some planned services remain unavailable, and certain data products are only accessible via the Butler. This section provides an overview of the available IVOA services and Butler access.

6.2.1. *IVOA Services*

Rubin has adopted a Virtual Observatory (VO)-first design philosophy, prioritizing compliance with IVOA standard interfaces to foster interoperability, standardization, and collaboration. In cases where standardized protocols have yet to be established, additional services have been introduced to complement these efforts. This approach ensures that the RSP can be seamlessly integrated with community-standard tools such as Tool for OPerations on Catalogues And Tables (TOPCAT) (Taylor 2011) and Aladin (Bonnarel et al. 2000; Boch & Fernique 2014; Baumann et al. 2022), as well as libraries such as PyVO (Graham et al. 2014).

The user-facing APIs are also used internally within the RSP, creating a unified design that ensures consistent and reproducible workflows across all three Aspects. This reduces code duplication, simplifies maintenance, and ensures all users, both internal and external, access data in the same way. For example, an Astronomical Data Query Language (IVOA standard) (ADQL) query on the `Object` catalog via TAP yields identical results whether run from the Portal, Notebook, or an external client.

Since the DP1 release, the RSP has continued to progress towards a full-featured platform, with a number of new services and capabilities added in support of DP2. The following IVOA services are available at the time of the DP2 release.

- **TAP service**: A TAP service (Dowler et al. 2019) enables queries of catalog data via the IVOA-standard ADQL, a dialect of SQL92 with spherical geometry extensions. The main TAP service for DP2 runs on the Rubin-developed Qserv database (§ 6.5), which hosts the core science tables described in §??, as well as the `Visit` database. It also provides image metadata in the IVOA `ObsCore` format via the standard `ivoa.ObsCore` table, making it an "ObsTAP" service (Louys et al. 2017). The TAP service is based on the Canadian Astronomy Data Centre (CADC)'s open-source Java TAP implementation[3], modified for the exact query language accepted by Qserv. Since DP1, ADQL support has been expanded to include the spatial `INTERSECTS()` operation, and temporary-table uploads now provide multi-object query capabilities across both Qserv- and Postgres-backed catalogs. It currently supports a large subset of ADQL, with limitations documented in the Data Release materials (see §??) and exposed via the TAP capabilities endpoint where possible.

  The TAP service provides metadata annotations consistent with the standard, including table and column descriptions, indications of foreign-key relationships between tables, and column metadata such as units and IVOA unified content descriptors (UCDs).

- **Image access services**: Rubin image access services are compliant with IVOA Simple Image Access Protocol, version 2 (SIAv2; Jenness et al. 2024; Dowler et al. 2015) for discovering and accessing astronomical images based on metadata. SIAv2 is a REpresentational State Transfer (REST)-based protocol designed for the discovery and retrieval of image data. It allows, for instance, querying all images in a given band over a defined sky region and time period.

  Users identify an image or observation of interest and query the service. The result set includes metadata about the image, such as the sky position, time, or band, and a data-access URL, which includes an IVOA Identifier uniquely identifying the dataset (Jenness & Dubois-Felsmann 2026), allowing the dataset to be retrieved or a cutout requested via Server-side Operations for Data Access (IVOA standard) (SODA) (SODA; Bonnarel et al. 2017).

[3] https://github.com/opencadc/tap

- **Image Cutout Service**: The Rubin Cutout Service (Allbery 2023, 2024) is based on the IVOA SODA standard (Bonnarel et al. 2017). Users submit requests specifying sky coordinates and the cutout size as the radius from the coordinates, and the service performs the operation on the full image and returns a result set. As with DP1, the Cutout Service for DP2 remains a single-cutout service, where N cutout requests require N independent synchronous calls; a bulk Cutout Service, (Jenness et al. 2026) is now planned for Data Release 1 (DR1).

- **HiPS Data Service**: An authenticated Hierarchical Progressive Survey (IVOA standard) (HiPS) (Fernique et al. 2017) Data Service for seamless pan-and-zoom access to large-scale coadds. It supports fast interactive progressive image exploration at a range of resolutions.

- **Web Distributed Authoring and Versioning (WebDav)**: A WebDav service is provided to enable users to remotely manage, edit, and organize files and directories on the RSP as if they were local files on their own computer. This is especially useful for local development.

Beyond these IVOA services, DP2 introduces expanded user query-history and query-status capabilities, initial context-aware, in-application documentation (e.g., contextual help linked directly from Portal table columns).

Looking ahead to DR1, planned RSP functionality includes bulk cutout services (both for individual targets across a range of epochs and for lists of multiple targets), a Point Spread Function (PSF) retrieval service, an on-demand forced-photometry service, data product recreation services, parallel and batch computing, support for persistent user-created databases and their federation with project-provided databases, support for collaborative work, and full LSSTCam focal-plane visualizations. Access to GPUs and the ability to bring additional user-funded compute resources to the RSP are under consideration for the post-DR1 period.

6.2.2. *Data Butler*

The Rubin Data Butler (Jenness et al. 2022; Lust et al. 2023), is a high-level interface designed to facilitate seamless access to data for both users and software systems. This includes managing storage formats, physical locations, data staging, and database mappings. A Butler repository contains two components.

- The *Data Store*. A physical storage system for datasets, e.g., a Portable Operating System Interface (POSIX) file system or (Amazon) Simple Storage Service (S3) object store.
- The *Registry*. A Structured Query Language (SQL)-compatible database that stores metadata about the datasets in the Data Store.

In the context of the Butler, a dataset refers to a unique data product, such as an image, catalog or map, generated by the observatory or processing pipelines. Datasets belong to one of the various types of data products, described in §3. The Butler ensures that each dataset is uniquely identifiable by a combination of three pieces of information: a data coordinate, a dataset type, and a run collection.

For a DP2 deep coadd on a patch of sky, the dimensions would be the tract, patch and band, specified as a dataId, e.g., `dataId={'tract': 11399, 'patch': 16, 'band': 'g'}` and is associated with the `deep_coadd` DatasetType. In contrast, the `visit_table` and `visit_detector_table` catalogs described in §3 have only the instrument dimension, since each is a single table covering all visits (or all visit-detector combinations) for a given instrument; retrieving either therefore requires only `dataId={'instrument': 'LSSTCam'}`. The `visit_summary` catalog, by contrast, is keyed on band, instrument, `day_obs`, `physical_filter`, and visit, e.g., `dataId={'instrument': 'LSSTCam', 'visit': 2025071100074, 'band': 'g', 'physical_filter': 'g_6', 'day_obs': 20250711}`, and contains one row per detector for that visit.

As for DP1, the EDP2 Butler repository containing the catalogs and coadds described in §3 is hosted in the Google Cloud using an S3-compatible store for datasets and AlloyDB, a PostgreSQL-compatible database for the Registry.

6.2.3. *Remote Programmatic Access*

The Rubin RSP API can be accessed remotely by data rights holders by creating a user security token. This token can then be used as a bearer token for API calls to the RSP services. This capability is especially useful for remote data analysis using tools such as TOPCAT, and for enabling third-party systems, such as community Alert brokers, to access Rubin data. Additionally, it supports remote development, allowing for more flexible workflows and integration with external systems.

6.3. *Portal Aspect*

The Portal Aspect provides an interactive web-based environment for exploratory data discovery, filtering, querying, and visualization of both image and catalog data, without requiring programming expertise. It enables users to access and analyze large datasets via tools for catalog queries, image browsing, time-series inspection, and crossmatching.

The Portal is built on Firefly (Wu et al. 2019), a web application framework developed by the Infrared Processing and Analysis Center. Firefly provides interactive capabilities such as customizable table views, image overlays, multipanel visualizations, and synchronized displays linking catalog and image data.

Designed to support both exploratory data access and detailed scientific investigation, the Portal delivers an intuitive user experience, allowing users to visually analyze data while retaining access to underlying metadata and query controls.

6.4. *Notebook Aspect*

The Notebook Aspect provides an interactive, web-based environment built on Jupyter Notebooks, enabling users to write and execute Python code directly on Rubin and LSST data without downloading it locally. It offers programmatic access to Rubin and LSST data products, allowing users to query and retrieve datasets, manipulate and display images, compute derived properties, plot results, and reprocess data using the LSST Science Pipelines (§??). The environment comes preinstalled with the Pipelines and a broad set of widely used astronomical software tools, supporting immediate and flexible data analysis.

6.5. *Databases*

The user-facing Aspects of the RSP are supported by several backend databases that store catalog data products, image metadata, and other derived datasets. The schema for DP2 and other Rubin databases are available online at https://sdm-schemas.lsst.io/dp2.html.

6.5.1. *Qserv*

The final 10 yr LSST catalog is expected to reach 15 PB and contain measurements for billions of stars and galaxies across trillions of detections. To support efficient storage, querying, and analysis of this dataset, Rubin Observatory developed Qserv (Wang et al. 2011; Mueller et al. 2025), a scalable, parallel, distributed SQL database system. Qserv partitions data over approximately equal-area regions of the celestial sphere, replicates data to ensure resilience and high availability, and uses shared scanning to reduce overall I/O load. It also supports a package of scientific user-defined functions (SciSQL[4]) simplifying complex queries involving spherical geometry, statistics, and photometry. Qserv is built on robust production-quality components, including MariaDB[5] and XRootD[6]. Qserv runs at the USDF and user access to catalog data is via the TAP service (§6.2.1). This enables catalog-based analysis through both the RSP Portal and Notebook Aspects.

While DP1 was small enough that Qserv's full capabilities were not strictly required, DP2, at 59.15 TB, is substantially larger and begins to exercise Qserv at a scale meaningfully closer to its intended operating regime, though still well short of the petabyte-scale catalogs expected for the 10 yr LSST survey.

Qserv is open-source and available on GitHub at https://github.com/lsst/qserv.

6.5.2. *OpSim*

DP2 provides an opsim-format SQLite database of visit-level observational metadata for the visits included in DP2, downloadable from https://s3df.slac.stanford.edu/data/rubin/sim-data/prelsst/dp2_visits.db, with additional documentation available at https://survey-strategy.lsst.io/progress/prelsst/prelsst_dp2.html#visit-database. Like the Butler `visit_table`, this database contains visit-level entries, but it has no equivalent of the `visit_detector_table` described in §?? and so provides no per-detector information. Its quantities (e.g., PSF FWHM, 5σ point-source depth) are drawn from the real-time Rapid Analysis QuickLook processing, () performed on the summit rather than from Data Release Processing (DRP) processing. Values may therefore differ somewhat from the corresponding DRP-derived quantities in the Butler `visit_table`. The database also includes some quantities not otherwise available from DRP outputs, such as AOS Zernike coefficients, as well as predicted quantities useful for comparison against simulated survey performance.

7. SUPPORT FOR COMMUNITY SCIENCE

Rubin Observatory's model to support its large, diverse science community to access and analyze DP2 focuses on providing documentation, tutorials, and live virtual learning opportunities alongside an open platform for issue reporting and resolution that enables crowd-sourced solutions. These support resources are all available via the main hub of Rubin's "For Scientists" website[7].

The data release documentation for DP2[8] provides an overview of the LSSTCam observations, data quality summary plots, and descriptions of the contents and access methods for all catalog and image datasets. All tutorials (NSF-DOE Vera C. Rubin Observatory 2021) that demonstrate DP2 access via the Rubin Science Platform are delivered in the data release documentation, and executable versions of the Jupyter notebook tutorials are also available from a drop-down menu within the Notebook Aspect.

Early DP2 was released on the first day of the annual Rubin Community Workshop, July 27 2026. A dedicated "Get started with DP2" session was added to the Wednesday agenda. Four DP2-onboarding virtual sessions were run in the first week of August, a mix of presentations, tutorials, and time for issue resolution.

The Rubin Community Forum[9] is the open platform for user issue reporting and resolution. Rubin staff monitor all new topics posted in the Support category and ensure that all requests for help get a response and a solution. The open nature of the platform also enables peer-to-peer support that avoids knowledge bottlenecks and hastens the time to resolution.

8. SUMMARY AND FUTURE RELEASES

DP2 provides the first release of science-grade data products from the LSSTCam focal plane. As for DP1, DP2 is part of Rubin's Early Science Program (Guy et al. 2026) and carries a 2 yr proprietary period during which access is restricted to LSST data rights holders via the cloud-based RSP.

DP2 is delivered in two phases: Early DP2 (EDP2), which provides deep coadded images, all science catalogs, and ancillary data products including throughput curves, survey property maps, and calibration products; and DP2, planned for late 2026, which adds single-epoch visit-level and difference-image data products to complete the release. The coadded images and catalogs delivered in EDP2 will not be reprocessed for DP2; the data are unchanged, and DP2 supersedes and fully encompasses EDP2 by adding the remaining products to the same release. Analyses begun on EDP2 products require no modification.

DP2 represents a substantial advance relative to DP1: the full LSSTCam focal plane replaces the single-raft LSSTComCam, all six *ugrizy* filters are available in

[4] https://smonkewitz.github.io/scisql/
[5] https://www.mariadb.org/
[6] https://xrootd.org/
[7] https://rubinobservatory.org/for-scientists
[8] https://dp2.lsst.io
[9] https://community.lsst.org/

place of three, and the sky area is larger by approximately two orders of magnitude. Nevertheless, DP2 reflects the state of an observatory still in the process of optimization: delivered image quality had not yet consistently reached design specification, template coverage is incomplete across the full sky, and several pipeline components remain under active development. Users are encouraged to consult the release documentation at https://dp2.lsst.io and the known issues register maintained there before beginning scientific analyses.

The body of science-grade LSSTCam data acquired between the end of the DP2 observing window on 2026-01-06 and the formal start of the LSST on 2026-06-29 will be processed and made available to LSST data rights holders through the same RSP services. The format and timing of this release are still under discussion; planning will be finalised once DP2 has been delivered.

The first LSST Data Release, DR1, will be derived from a reprocessing of approximately the first year of LSST survey data and is currently expected in mid-2028; its precise definition remains under consideration. DR1 will mark a qualitative advance beyond DP2: observations collected under the community-developed baseline survey strategy (Rubin's Survey Cadence Optimization Committee et al. 2022, 2023, 2025; The Rubin Observatory Survey Cadence Optimization Committee 2026) will yield substantially broader and more uniform sky coverage across the full Wide-Fast-Deep (WFD) footprint of 18000 deg^2, a balanced six-band filter distribution, and improved delivered image quality as AOS and dome thermal management continue to mature (NSF-DOE Vera C. Rubin Observatory 2026). Photometric and astrometric calibration will benefit from a full year of all-sky coverage, difference-imaging templates will span a far greater fraction of the footprint and processing will draw on a more mature version of the LSST Science Pipelines refined through DP2 experience and community engagement. Subsequent LSST Data Releases are planned at an approximately yearly cadence, each a complete reprocessing of all survey data accumulated to that point, with progressively deeper coadds and improved calibration. Plans will be updated through revisions to Guy et al. (2026) and on the Rubin community forum at https://community.lsst.org.

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Facilities: Rubin:Simonyi (LSSTComCam), Rubin:USDAC

Software: Rubin Data Butler (Jenness et al. 2022), LSST Science Pipelines (Rubin Observatory Science Pipelines Developers 2025), LSST Feature Based Scheduler v3.0 (Jones 2026) Astropy (Astropy Collaboration et al. 2013, 2018, 2022) PIFF (Jarvis et al. 2021), GBDES (Bernstein 2022), Qserv (Wang et al. 2011; Mueller et al. 2025), Slurm, HTCondor, CVMFS, FTS3, ESNet

APPENDIX

Glossary

ADQL: Astronomical Data Query Language (IVOA standard).

AOS: Active Optics System.

API: Application Programming Interface.

AURA: Association of Universities for Research in Astronomy.

Butler: A middleware component for persisting and retrieving image datasets (raw or processed), calibration reference data, and catalogs.

CADC: Canadian Astronomy Data Centre.

cloud: A visible mass of condensed water vapor floating in the atmosphere, typically high above the ground or in interstellar space acting as the birthplace for stars. Also a way of computing (on other peoples computers leveraging their services and availability).

DAC: Data Access Center.

Data Management System: The computing infrastructure, middleware, and applications that process, store, and enable information extraction from the LSST dataset; the DMS will process petascale data volume, convert raw images into a faithful representation of the universe, and archive the results in a useful form. The infrastructure layer consists of the computing, storage, networking hardware, and system software. The middleware layer handles distributed processing, data access, user interface, and system operations services. The applications layer includes the data pipelines and the science data archives' products and services.

DOE: Department of Energy.

DP0: Data Preview 0.

DP1: Data Preview 1.

DP2: Data Preview 2.

DR1: Data Release 1.

DRP: Data Release Processing.

EDP2: Early Data Preview 2.

Firefly: A framework of software components written by IPAC for building web-based user interfaces to astronomical archives, through which data may be searched and retrieved, and viewed as FITS images, catalogs, and/or plots. Firefly tools will be integrated into the Science Platform.

HiPS: Hierarchical Progressive Survey (IVOA standard).

IVOA: International Virtual Observatory Alliance.

LSST: Legacy Survey of Space and Time.

LSSTCam: LSST Science Camera.

LSSTComCam: Rubin Commissioning Camera.

metadata: General term for data about data, e.g., attributes of astronomical objects (e.g. images, sources, astroObjects, etc.) that are characteristics of the objects themselves, and facilitate the organization, preservation, and query of data sets (e.g., a FITS header contains metadata).

NSF: National Science Foundation.

patch: An quadrilateral sub-region of a sky tract, with a size in pixels chosen to fit easily into memory on desktop computers.

POSIX: Portable Operating System Interface.

PPDB: Prompt Products DataBase.

PSF: Point Spread Function.

Qserv: LSST's distributed parallel database. This database system is used for collecting, storing, and serving LSST Data Release Catalogs and Project metadata, and is part of the Software Stack.

REST: REpresentational State Transfer.

RSP: Rubin Science Platform.

S3: (Amazon) Simple Storage Service.

schema: The definition of the metadata and linkages between datasets and metadata entities in a collection of data or archive.

SODA: Server-side Operations for Data Access (IVOA standard).

software: The programs and other operating information used by a computer.

SQL: Structured Query Language.

TAP: Table Access Protocol (IVOA standard).

TOPCAT: Tool for OPerations on Catalogues And Tables.

tract: A portion of sky, a spherical convex polygon, within the LSST all-sky tessellation (sky map). Each tract is subdivided into sky patches.

USDF: United States Data Facility.

VO: Virtual Observatory.

WebDav: Web Distributed Authoring and Versioning.

WFD: Wide-Fast-Deep.

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