

Data Management Plan for Calar Alto Observatory (CAHA)

1. Description of the Data

- **Types of Data:**
 - Observational data: Includes raw and reduced astronomical data such as images and spectra using the observatory's instruments.
 - Calibration data: Essential for processing observational data, including bias frames, flat fields, and dark frames.
 - Metadata: Includes information about observation times, instrument configurations, weather conditions, and data quality metrics.
 - Sky quality data: Continuous measurements of atmospheric conditions like seeing, extinction, and light pollution levels.
- **Formats and Standards:**
 - Observational data are stored in FITS (Flexible Image Transport System), a widely used format in the astronomical community.
 - Metadata and processed data use interoperable formats like JSON, CSV, and VO-compliant standards to ensure compatibility with Virtual Observatory platforms.
- **Estimated Data Volume:**
 - The observatory generates approximately 50 TB of data annually, depending on observing programs and instruments.

2. Storage and Organization

- **Infrastructure:**
 - Primary storage is provided by high-capacity servers located on-site at the observatory.
- **Real-Time Management:**
 - During nightly operations, raw data are temporarily stored in RAID arrays for immediate access and processing.
 - Post-observation, data are transferred to the central archive system for secure storage and long-term preservation.
- **Backup and Security:**
 - Backups are conducted monthly.
 - Security measures include restricted access to data storage systems, encryption, and firewalls to protect against cyber threats.

3. Access and Sharing

- **Access During the Project:**
 - Researchers involved in observational programs have access to their data through secure web portals or direct FTP access.
 - Technical staff at CAHA can access data for maintenance, troubleshooting, and quality control.
- **Public Access:**
 - Data become publicly available after a standard embargo period of 12 months, during which only the primary investigators can access their data.

- Public access is provided through the CAHA Data Archive and Virtual Observatory platforms, ensuring global accessibility.
- **Licensing and Restrictions:**
 - Public data requires proper citation of CAHA and the associated projects.
 - Data from collaborative projects with sensitive content may have additional access restrictions as defined by the agreements.

4. Preservation and Archiving

- **Long-Term Preservation:**
 - Data is secured by a RAID5 and RAID6 within the archive. Last year data is stored in a separate archive and then all data is downloaded on USB disks stored in a secure location. Public data is also transferred to the Madrid Virtual Observatory once the embargo ends.
- **Archival Strategies:**
 - The CAHA archive is integrated with national repositories as the Virtual Observatory at CAB.
 - A retention policy defines that all observational data will be preserved indefinitely, ensuring their availability for future research.

5. Ownership and Rights

- **Data Ownership:**
 - Observational data are co-owned by CAHA and the primary investigators responsible for the observing programs.
 - Ownership rights are detailed in agreements signed during the time allocation process.
- **Licensing:**
 - Publicly released data follow open-access principles to encourage reuse while ensuring proper attribution.
 - Proprietary data remain restricted according to the guidelines defined by the Time Allocation Committee (TAC).

6. Compliance with Regulations

- **Data Protection:**
 - Personal data of researchers and users are protected under the General Data Protection Regulation (GDPR).
 - Measures such as anonymization and secure handling are implemented for sensitive data.
- **Community Standards:**
 - CAHA adheres to International Virtual Observatory Alliance (IVOA) standards for data sharing and metadata organization.
 - Compliance with funding agency policies ensures alignment with national and European research data management requirements.