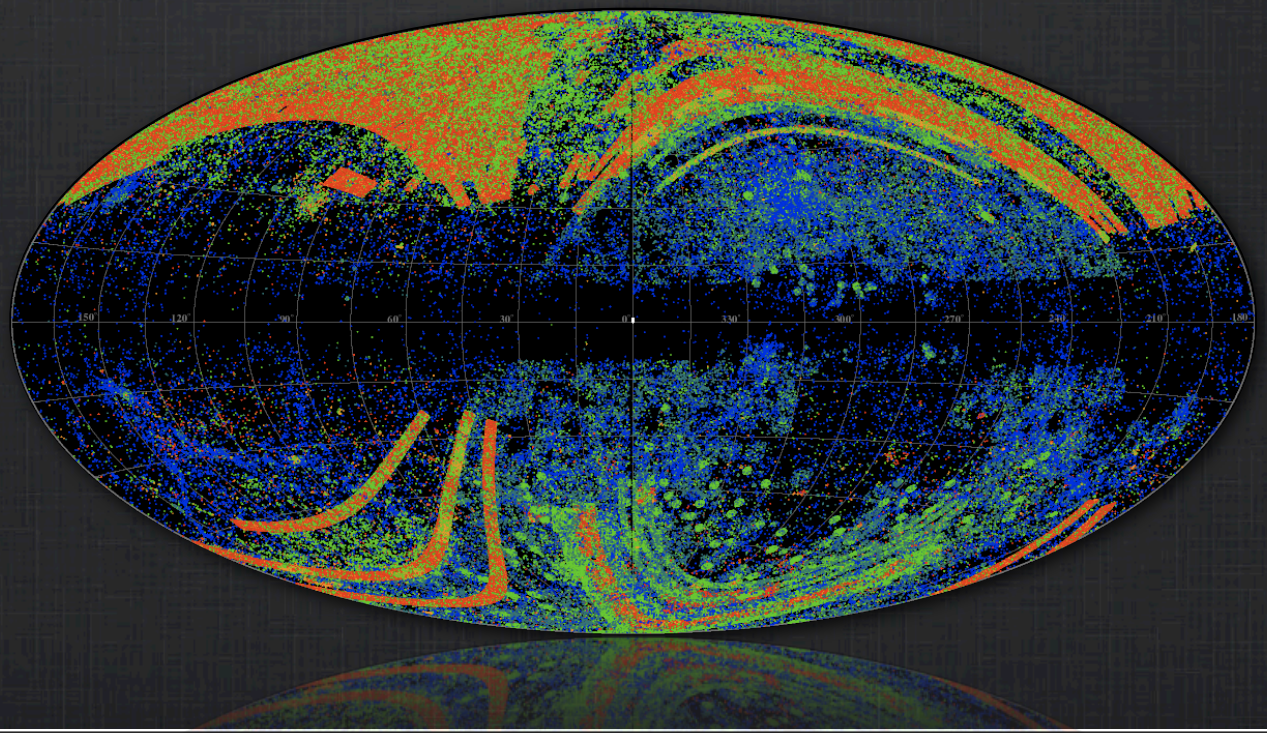
ipac
GRITS 2009

NASA/IPAC Extragalactic Database

20 years, 163 million objects, 3.3 billion rows, and beyond

The NED Team

Rick Ebert presenting



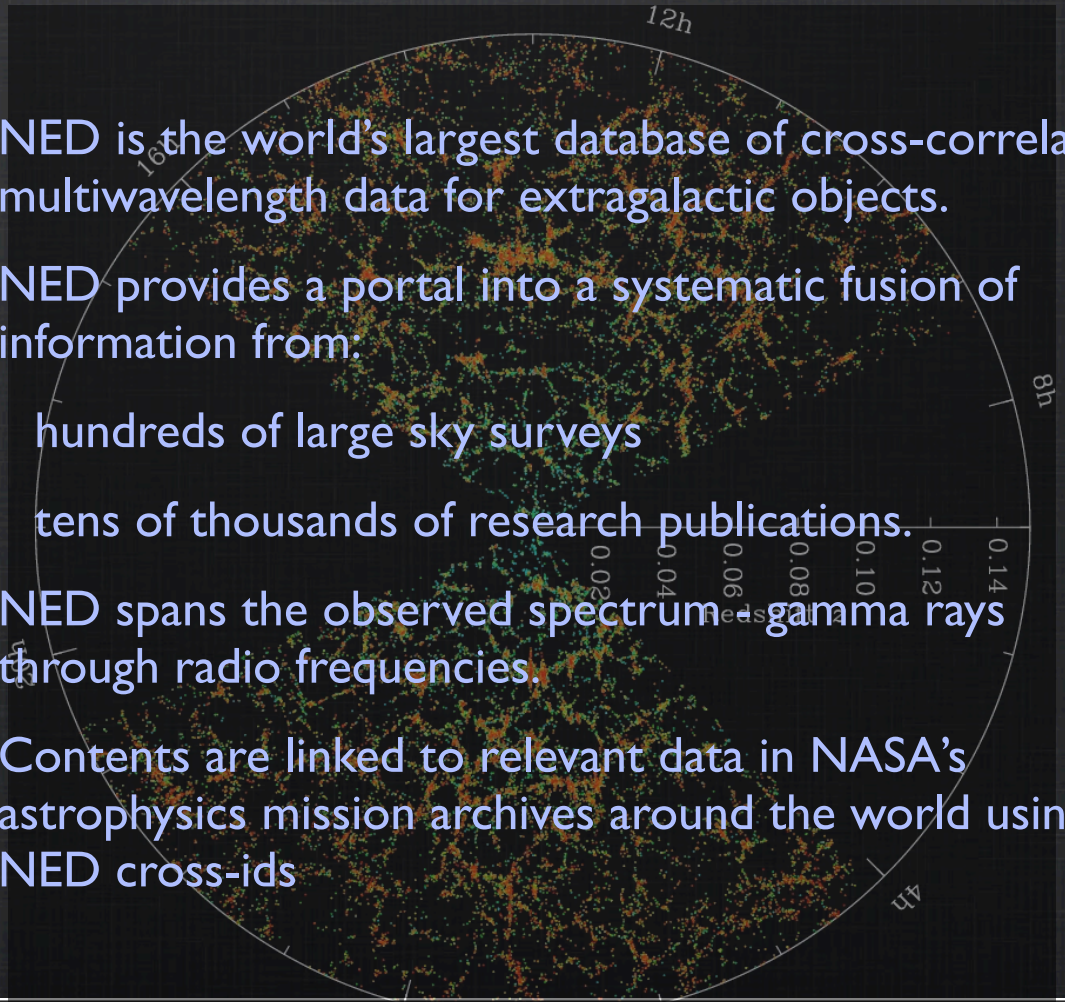
NED

What is **NED**?

- Mission
- A brief history
  - 20 years, 3 dbms, multiple uif
- The System
  - Current holdings
  - Connections to:
    - IRSA, Google, Microsoft WWT, NVO/VAO
- The Future
  - new data sets
  - new dbms (extracting the schema, and leaving behind the one-dbms model)
  - detachable queries (backgrounding)
  - improved support for external systems

NED

- NED is the world's largest database of cross-correlated multiwavelength data for extragalactic objects.
- NED provides a portal into a systematic fusion of information from:
  - hundreds of large sky surveys
  - tens of thousands of research publications.
- NED spans the observed spectrum - gamma rays through radio frequencies.
- Contents are linked to relevant data in NASA's astrophysics mission archives around the world using NED cross-ids



NED

the Mission

- Provide the most current, comprehensive and easy-to-use integration of multi-wavelength information for all known extragalactic objects.
  - NED is a synthesis of extragalactic data spanning all NASA astrophysiscs missions, large sky surveys and the peer-reviewed literature.
  - NED is the first port-of-call for most extragalactic researchers; and is integral to all phases of research
  - NED is a cornerstone to NASA, NSF and international efforts to construct a collaborative and distributed *Virtual Observatory*

NED

NED statistics

- Interface last updated: 16 April 2009
  - 163 million objects
  - 170 million multiwavelength object cross-IDs
  - 188 thousand associations (candidate cross-IDs)
  - 1.4 million redshifts
  - 1.7 billion photometric measurements
  - 609 million diameter measurements
  - 5.0 million objects linked to 68,354 refereed journal articles
  - 2.3 million images, maps and external links
  - 65 thousand notes
  - 45 thousand abstracts
  - 56 thousand spectra

NED in a nutshell

NED

Astrophysics Literature

Objects, Measurements, Attributes, Images, Spectra

Individual scientists and research teams
- Interactive & automated queries
- Data Analysis & Discovery
- Publication

NED

NASA Astrophysics Mission Archives

MAST IRSA HST CGRO SPITZER CHANDRA

gamma x-ray visible light infrared

WAVELENGTH 0.0005 0.5 500 10,000 5,000,000,000 nanometers

ENERGY 2,480,000 2.480 2.48 0.124 0.000000248

HEASARC High Energy Astrophysics Science Archive Research Center

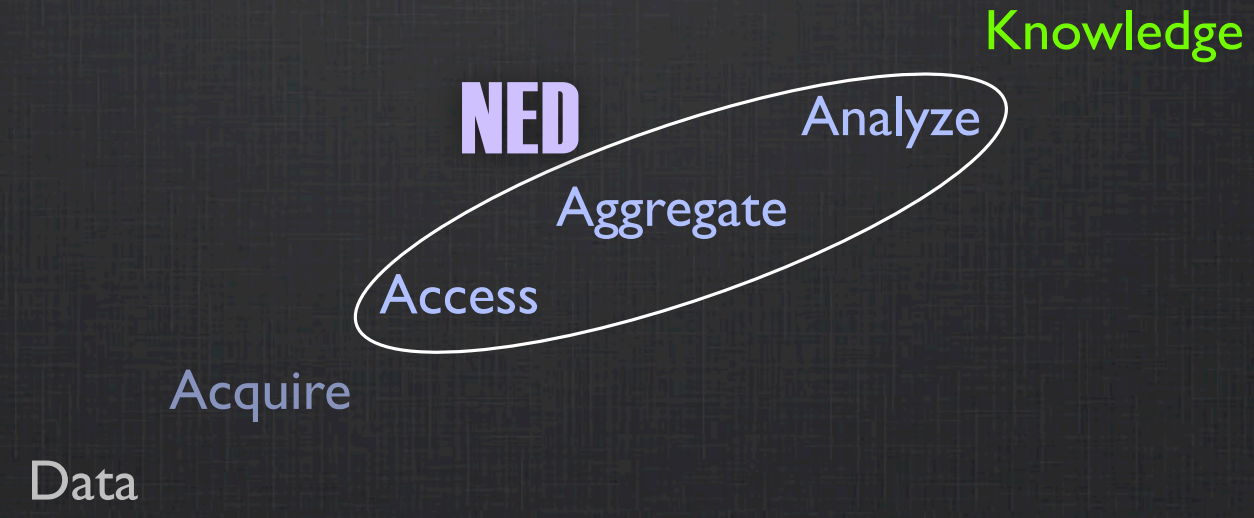
NVO

WISE 2MASS 2 MICRON ALL SKY SURVEY Pan-STARRS JWST SDSS GALEX Galaxy Evolution Explorer

Sky surveys, present & future

NED

our mission



NED

a quick history

- 1985 - IPAC created
- May 1987 - Submission of NED proposal to NASA
- 1988 - CDs first marketed
- June 1990 - NED First public release
- Nov 1990 - Berners-Lee & Cailliau propose WWW
- 1991 - NED migrates from Control Data/IMDM to Sybase
- 1992 - Astrophysics Data System starts operating
- 1993 - DVD *invented*
- 1995 - NED migrates from Sybase to Informix
- 1995 - Netscape debuts/NCSA HTTPd copyright
- March 25, 1999 - Apache debuts
- Aug 25, 2003 - Spitzer Telescope launched
- June 27, 2007 - NED passes 10 million objects
- Dec 17, 2008 - NED includes SDSSdr6: 164 million
- May 14, 2009 - Herschel/Planck launched

NED

IPAC Interface to NED

Preliminary Design Description

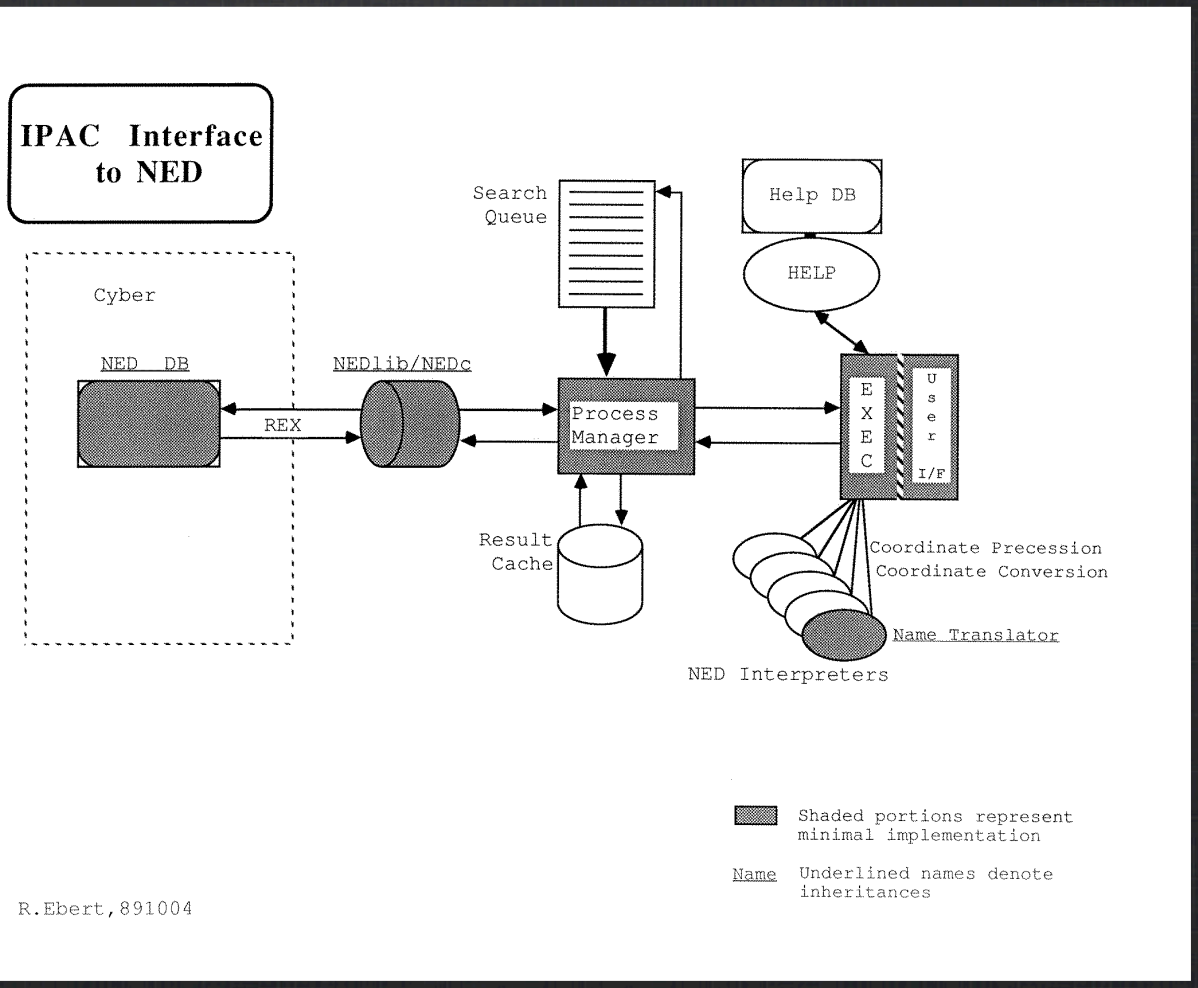
R. Ebert
October 6, 1989
Rev. October 18, 1989

Abstract

NED, the NASA/IPAC Extragalactic Database, is an electronic compendium of catalogued and researched extragalactic objects. One of the primary goals of NED is to provide access to the database by a world-wide community of researchers in Astronomy. Toward that end we present here the design of a software system to provide an approachable user interface for an astronomer wishing to access NED from a remote location using national computer networks or dial-up phone lines. Two versions of the plan are presented: a rapid implementation version intended to give minimal functionality in 2-3 months; and a more robust version that might be implemented in 8-12 months.

Introduction

The NED is a compendium of astronomical catalogue and other information


IPAC Interface to NED
Search Queue
Help DB
HELP
Cyber
NED DB
NEDlib/NEDc
REX
Process Manager
E X E C
U s e r I/F
Result Cache
Coordinate Precession
Coordinate Conversion
Name Translator
NED Interpreters
Shaded portions represent minimal implementation
Name Underlined names denote inheritances
R.Ebert,891004

NED

Screen Dump – Fri Dec 8 18:36:30 1989

YAMM interface -1989

0:By_Name 1:Near_Name **2:Near_Position** 3:Help

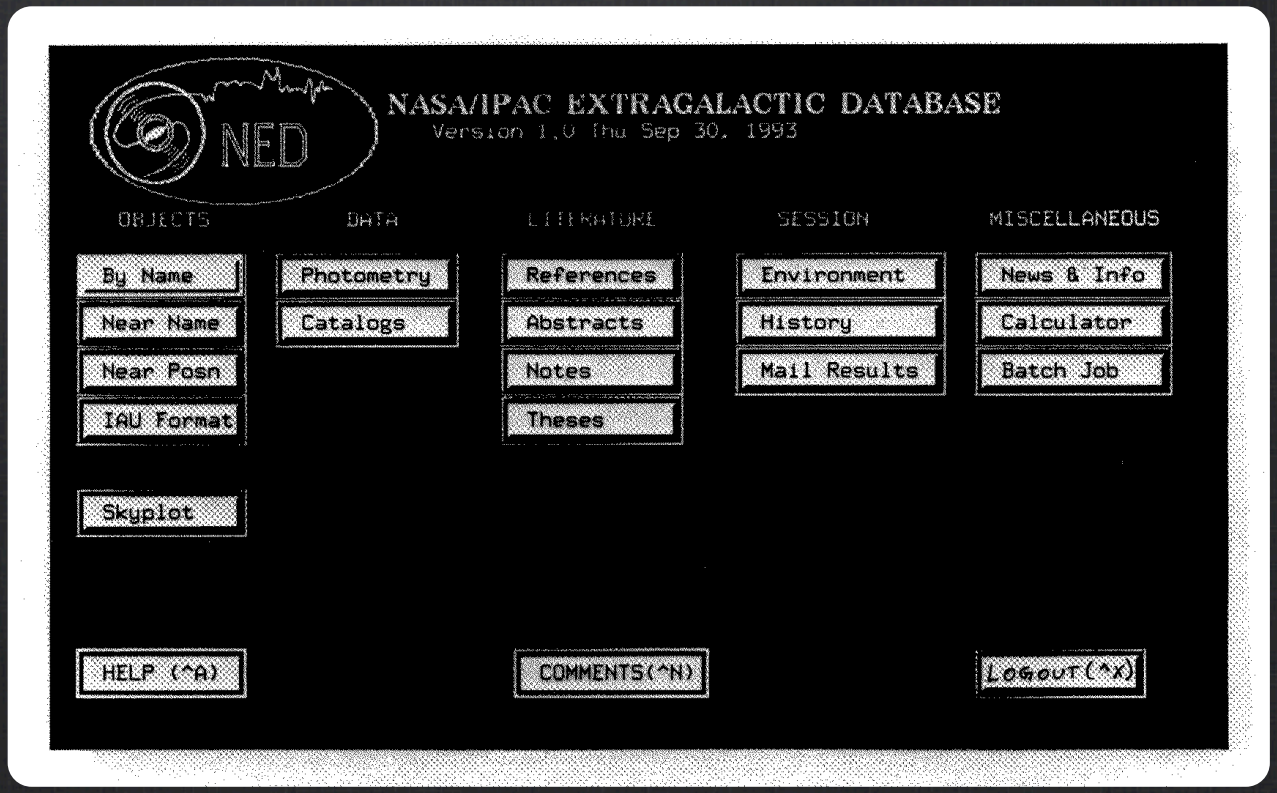
RA _____
Dec _____ Input Epoch 2000

Search Radius [Arc Minutes] _____

Search	^H=Help	^P=Abort data entry	^T=Next value	^L=Refresh
	^E=End data entry	^D=Hardcopy	TAB=Next field	

NED

JAMM interface -1993



NED

NASA/IPAC EXTRAGALACTIC DATABASE

- Latest Updates
- Updates to Level5 Knowledgebase
- New 2200 HI spectra from Nançay Observations
- New Spitzer IRAC and HST ACS images, and VLA maps
- Frames

Notice: Ongoing upgrades to the user interface include significant changes to the HTML query reports. Automated queries should use VOTable (XML) output. Details

OBJECTS	DATA	LITERATURE	TOOLS	INFO
By Name	Images By Object Name or By Region	References by Object Name	Coordinate Transformation & Extinction Calculator Velocity Calculator	FAQ Introduction
Near Name	Photometry & SEDs	References by Author Name	Cosmology Calculators Extinction-Law Calculators	Features Graphical Overview
Near Position	Spectra	Text Search	FTP	NED Source List
Advanced All-Sky	Redshifts	Knowledgebase	X/Y offset to RA/DEC	Team
IAU Format	Positions	Distances	Batch Job Submission	Comment
By Refcode	Notes	Abstracts	Pick Up Batch Job Results	Web Links
	Diameters	Thesis Abstracts	Skyplot	Glossary & Lexicon

Interface last updated: 16 April 2009

- 163 million objects
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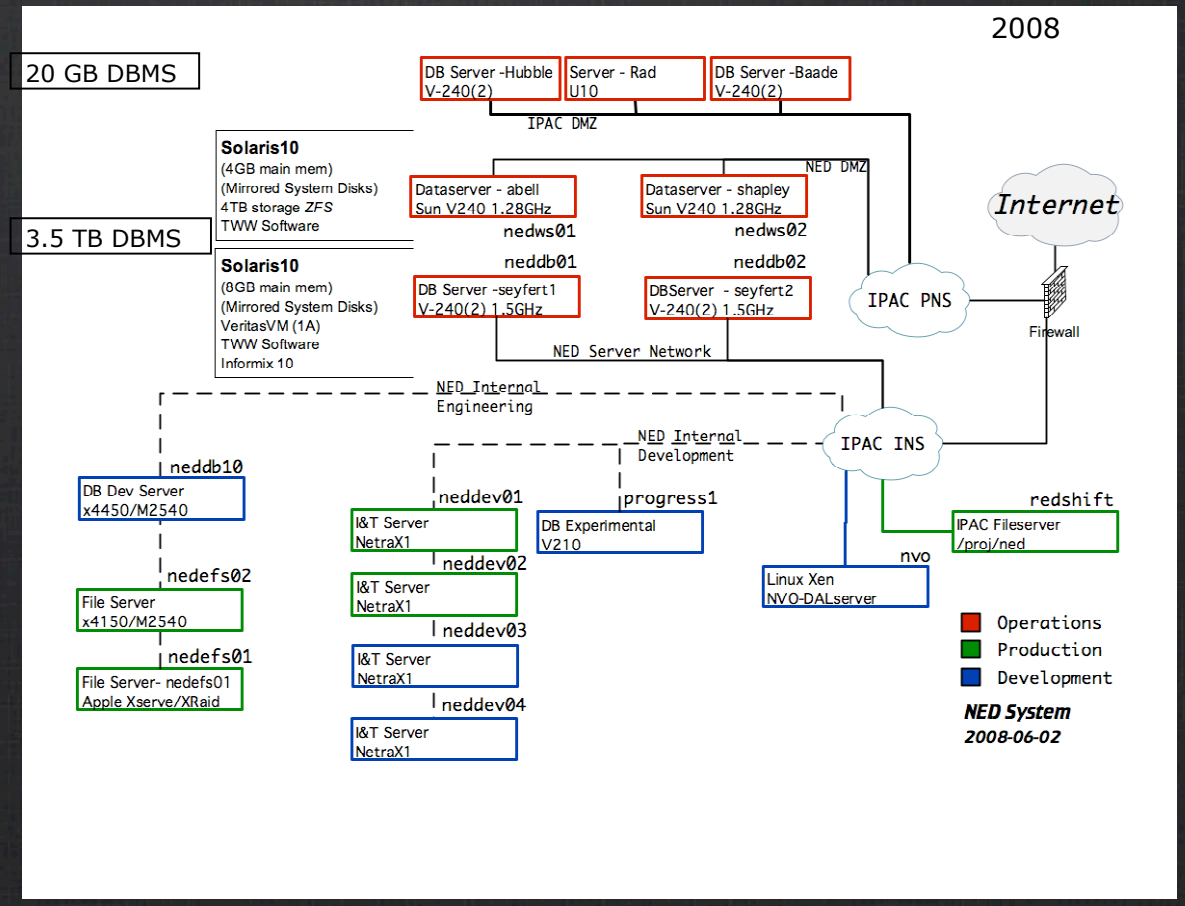
If your research benefits from the use of NED, we would appreciate the following acknowledgement in your paper: *This research has made use of the NASA/IPAC Extragalactic Database (NED) which is operated by the Jet Propulsion Laboratory, California Institute of Technology, under contract with the National Aeronautics and Space Administration.*

NED

technology

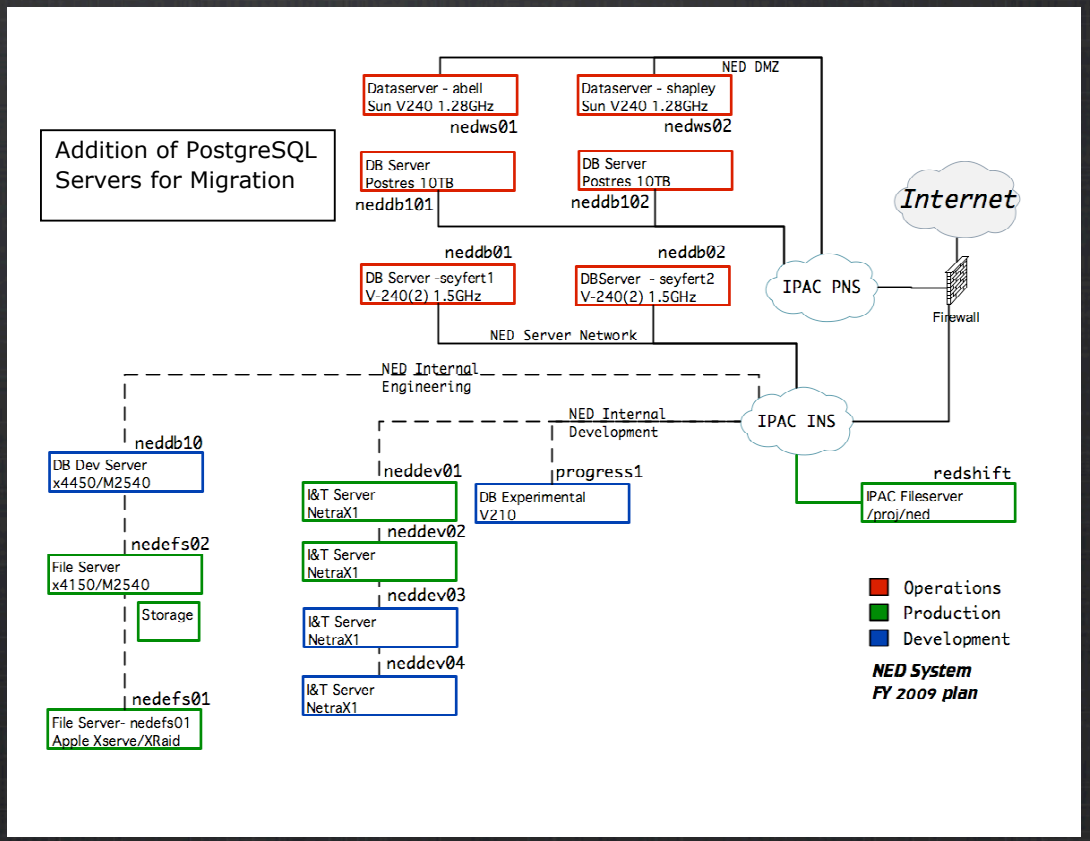
- stateless: query-report
- 3 interfaces: email, www, nedsrv
  - apache - cgi
    - html, xml, text
  - C, C++, Perl
    - php, python, ruby, fortran can coexist
- IBM-IDS (formerly: Informix OnLine Dynamic server)

NED


2008
20 GB DBMS
3.5 TB DBMS
Solaris10
(4GB main mem)
(Mirrored System Disks)
4TB storage ZFS
TWW Software
Solaris10
(8GB main mem)
(Mirrored System Disks)
VeritasVM (1A)
TWW Software
Informix 10
DB Server -Hubble V-240(2)
Server - Rad U10
DB Server -Baade V-240(2)
IPAC DMZ
NED DMZ
Dataserver - abell Sun V240 1.28GHz
nedws01
Dataserver - shapley Sun V240 1.28GHz
nedws02
neddb01
DB Server -seyfert1 V-240(2) 1.5GHz
neddb02
DBServer - seyfert2 V-240(2) 1.5GHz
IPAC PNS
Internet
Firewall
NED Server Network
NED Internal Engineering
NED Internal Development
IPAC INS
neddb10
DB Dev Server x4450/M2540
nedefs02
File Server x4150/M2540
nedefs01
File Server- nedefs01 Apple Xserve/XRaid
neddev01
I&T Server NetraX1
neddev02
I&T Server NetraX1
neddev03
I&T Server NetraX1
neddev04
I&T Server NetraX1
progress1
DB Experimental V210
redshift
IPAC Fileserver /proj/ned
nvo
Linux Xen NVO-DALserver
Operations
Production
Development
NED System
2008-06-02

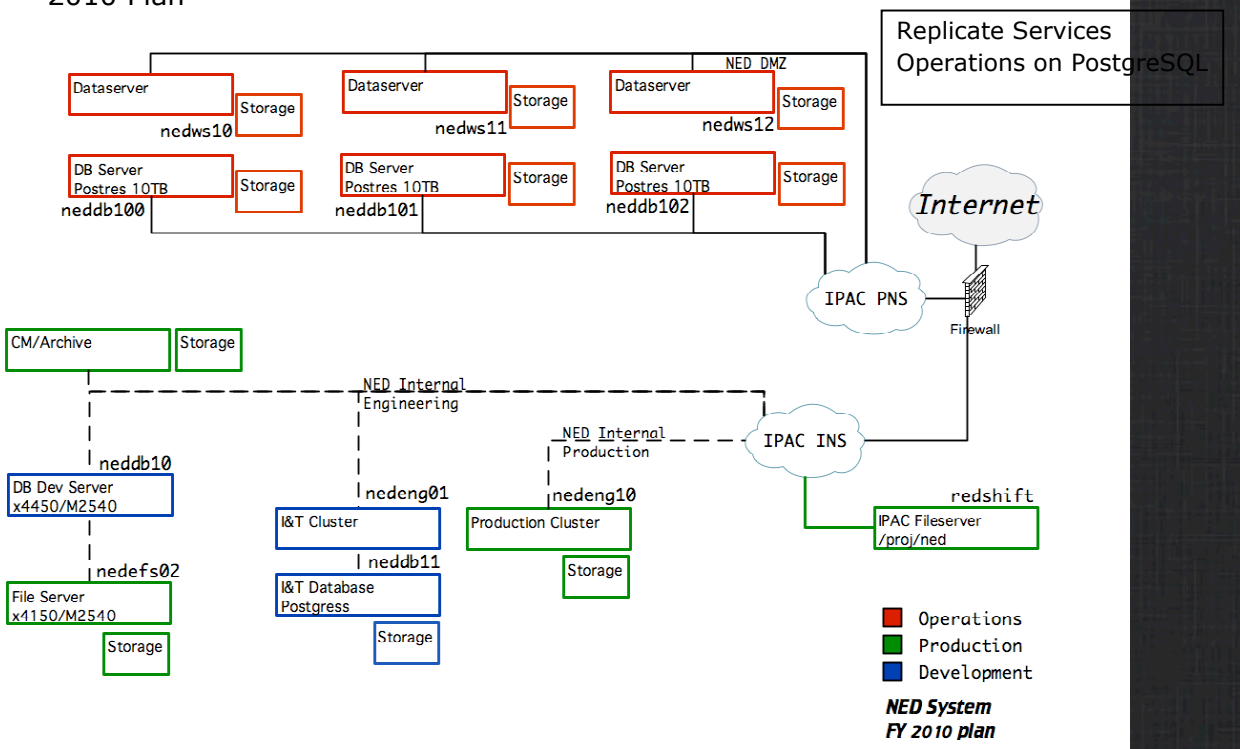
NED

Addition of PostgreSQL Servers for Migration



NED

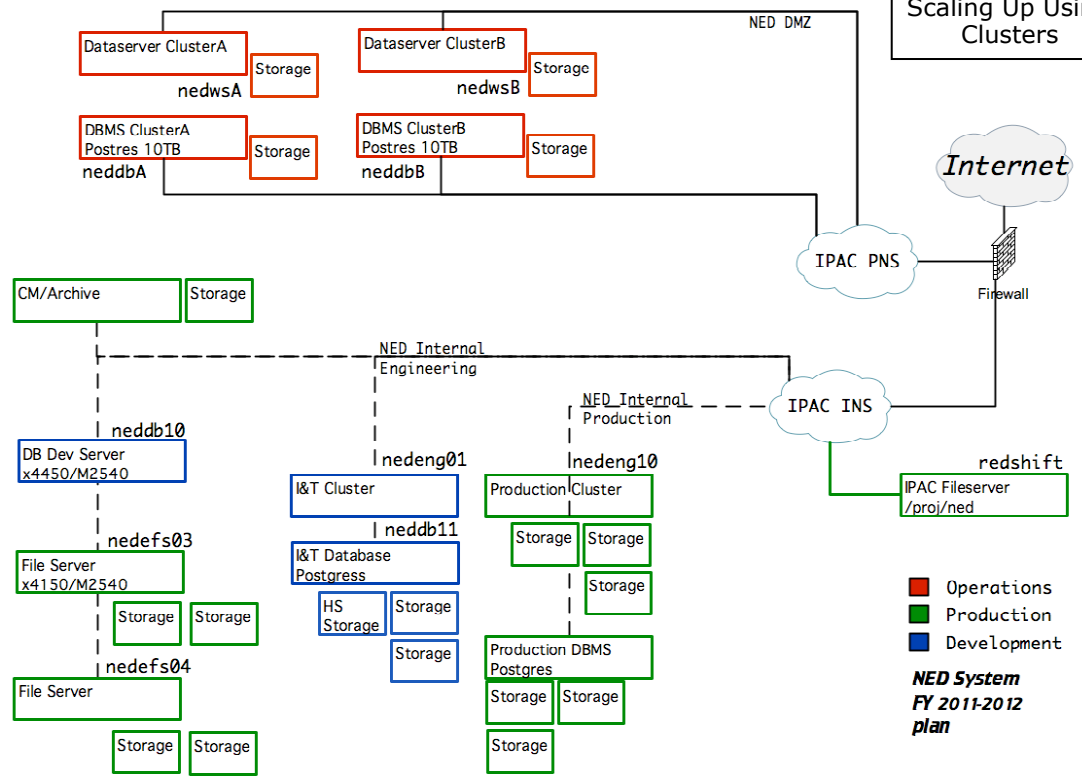
2010 Plan



NED

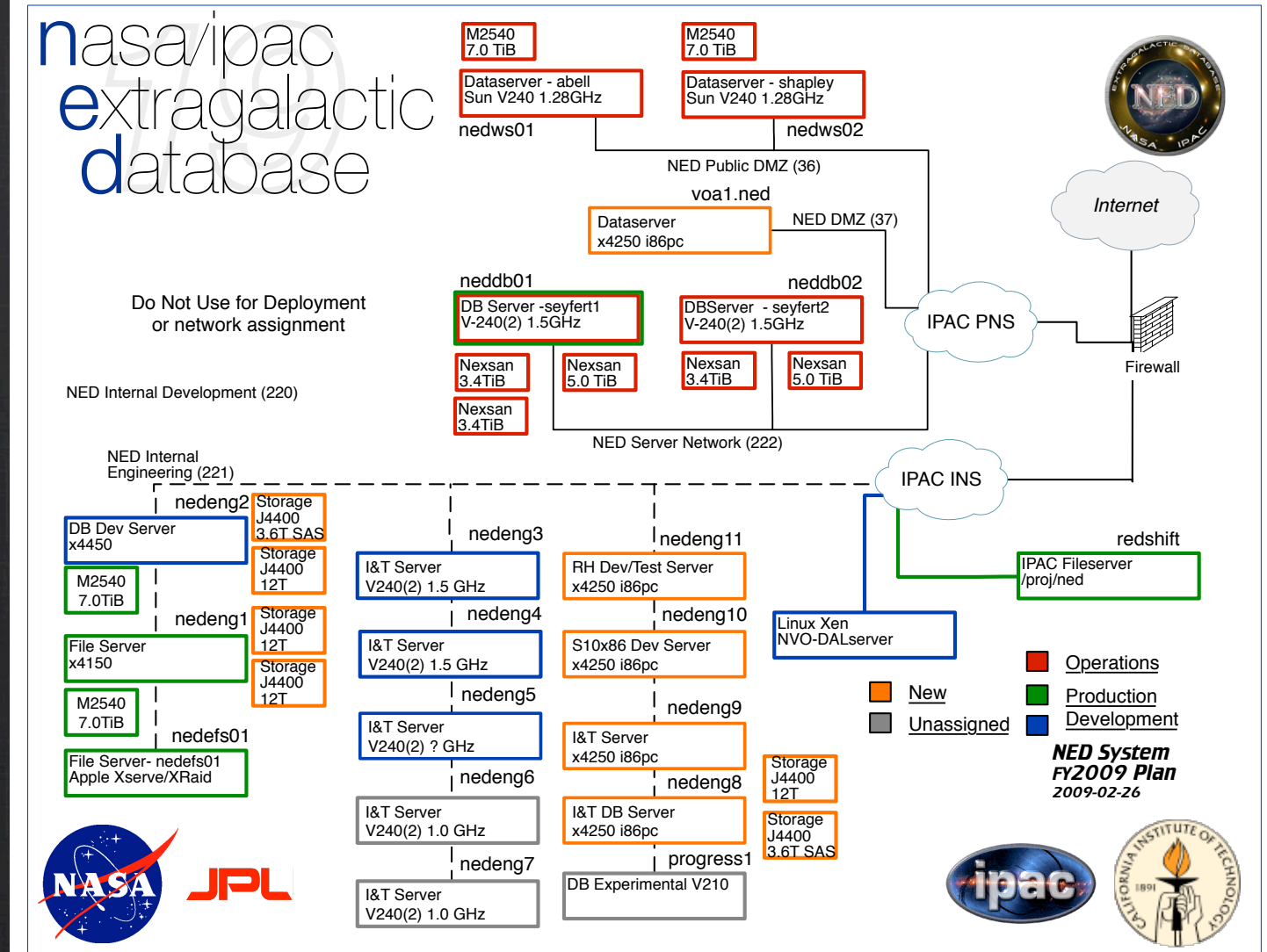
2011-2012 Plan

Scaling Up Using Clusters



NED

nasa/ipac extragalactic database



NED

The Future

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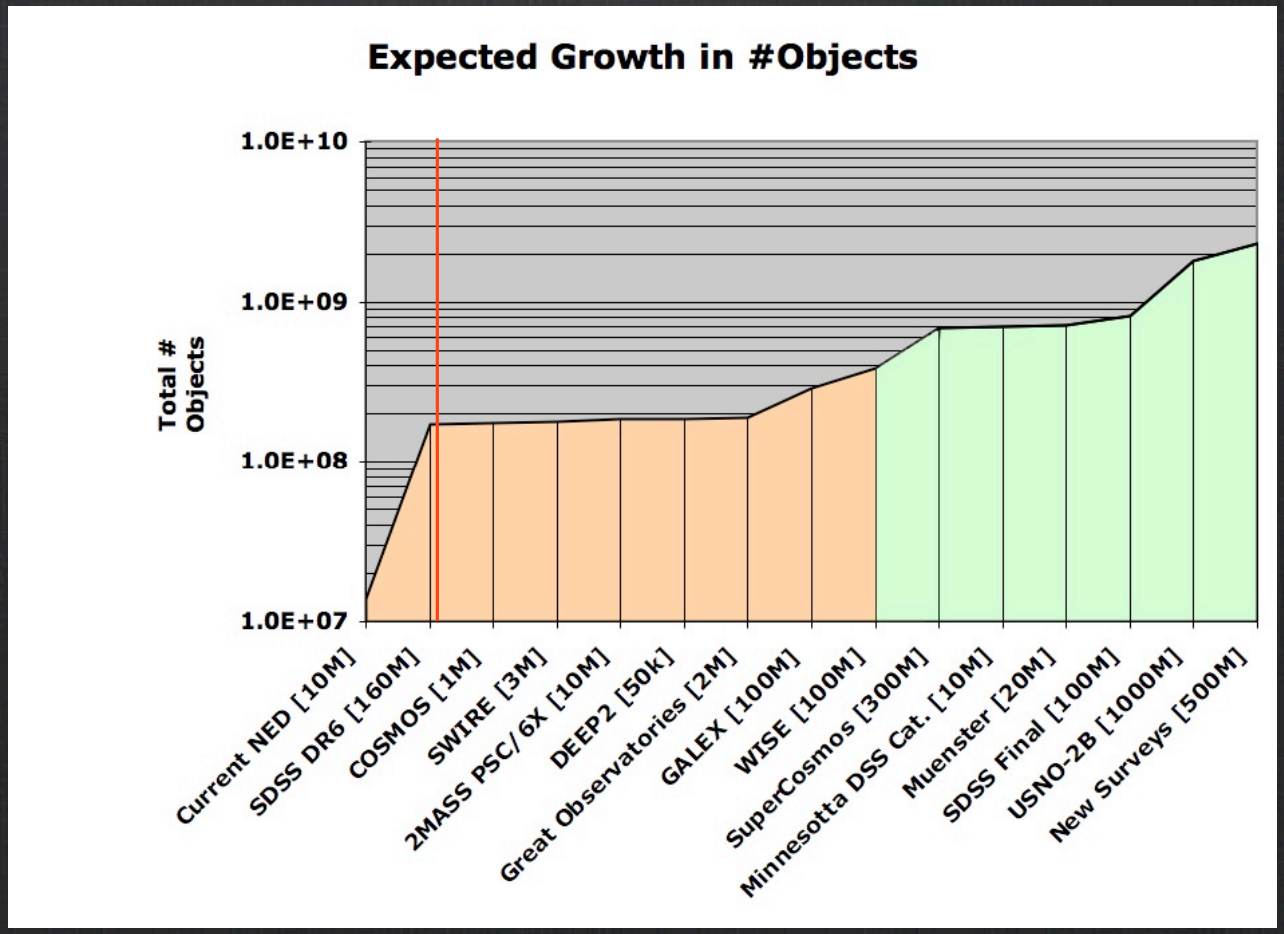
NED


Expected Growth in #Objects
Total # Objects
1.0E+10
1.0E+09
1.0E+08
1.0E+07
Current NED [10M]
SDSS DR6 [160M]
COSMOS [1M]
SWIRE [3M]
2MASS PSC/6X [10M]
DEEP2 [50K]
Great Observatories [2M]
GALEX [100M]
WISE [100M]
SuperCosmos [300M]
Minnesotta DSS Cat. [10M]
Muenster [20M]
SDSS Final [100M]
USNO-2B [1000M]
New Surveys [500M]

NED

NED is scaling up

- To handle modern sky surveys with hundreds of millions of objects.
  - NED has integrated its first 'extremely large' data set (15x):
    - 154 million objects from the Sloan Digital Sky Survey (SDSS) Data Release 6 (DR6) photometric catalog. These are a subset of the 217 million objects in DR6 selected using "Clean sample" filters recommended by the SDSS project
- To handle increased demand of automated queries

NED

Automated usage is continuing to increase:

- Supernovae search preparing for Pan-STARRS (U. Belfast)
- Digital H I Archive group (Cornell)
- PAIRITEL: IR Robotic follow-up of GRB localizations (UC Berkeley)

This is wonderful, but has a significant impact:

- Interactive response time is noticeably degraded
- Requires more user support
- Additional monitoring
- Guidelines for automated use posted online

NED

NED 20

- stateful: interactive sessions, detachable/queue-able queries
- 2? interfaces: www, email?
  - apache - html, xml, text
- and...

NED

The elephant in the room and the next challenge

ORACLE

SYBASE

Microsoft SQL Server 2008

PostgreSQL

MySQL

INGRES

IBM DB2 IDS

PROGRESS SOFTWARE

D3

ANTs Software

SQLite

NED

Find the strength in the technology and exploit it;
Find the weakness and avoid it.

- NED has ridden its share of DBMSs
- Capability, Cost, and Longevity
- Exploit, but don't buy in all-the-way
- The decoupled database: Strategies for staying out of the jaws of the DBMS vendors...

NASA/IPAC EXTRAGALACTIC DATABASE

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