

NAIF - Navigation and Ancillary Information Facility

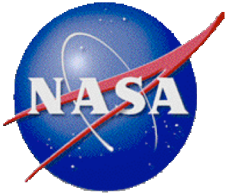
Accessing and Using MEX SPICE Observation Geometry Data

**First Mars Express Science Conference
ESTEC**

**Charles Acton
Jorge Diaz
Joe Zender**

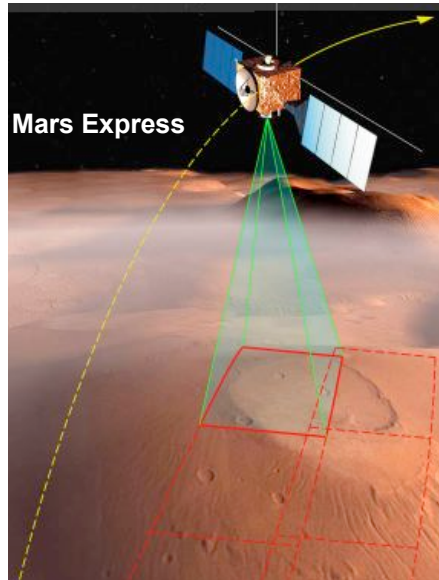
February 21, 2005

The SPICE system has been developed by the Jet Propulsion Laboratory, California Institute of Technology,
under contract with the National Aeronautics and Space Administration.



SPICE Provides Geometry Data

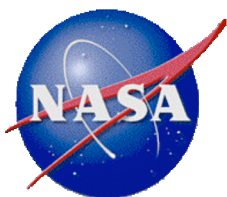
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- **SPICE data may be used to compute a wide assortment of observation geometry and timing information that is necessary or helpful in understanding MEX's science observations.**

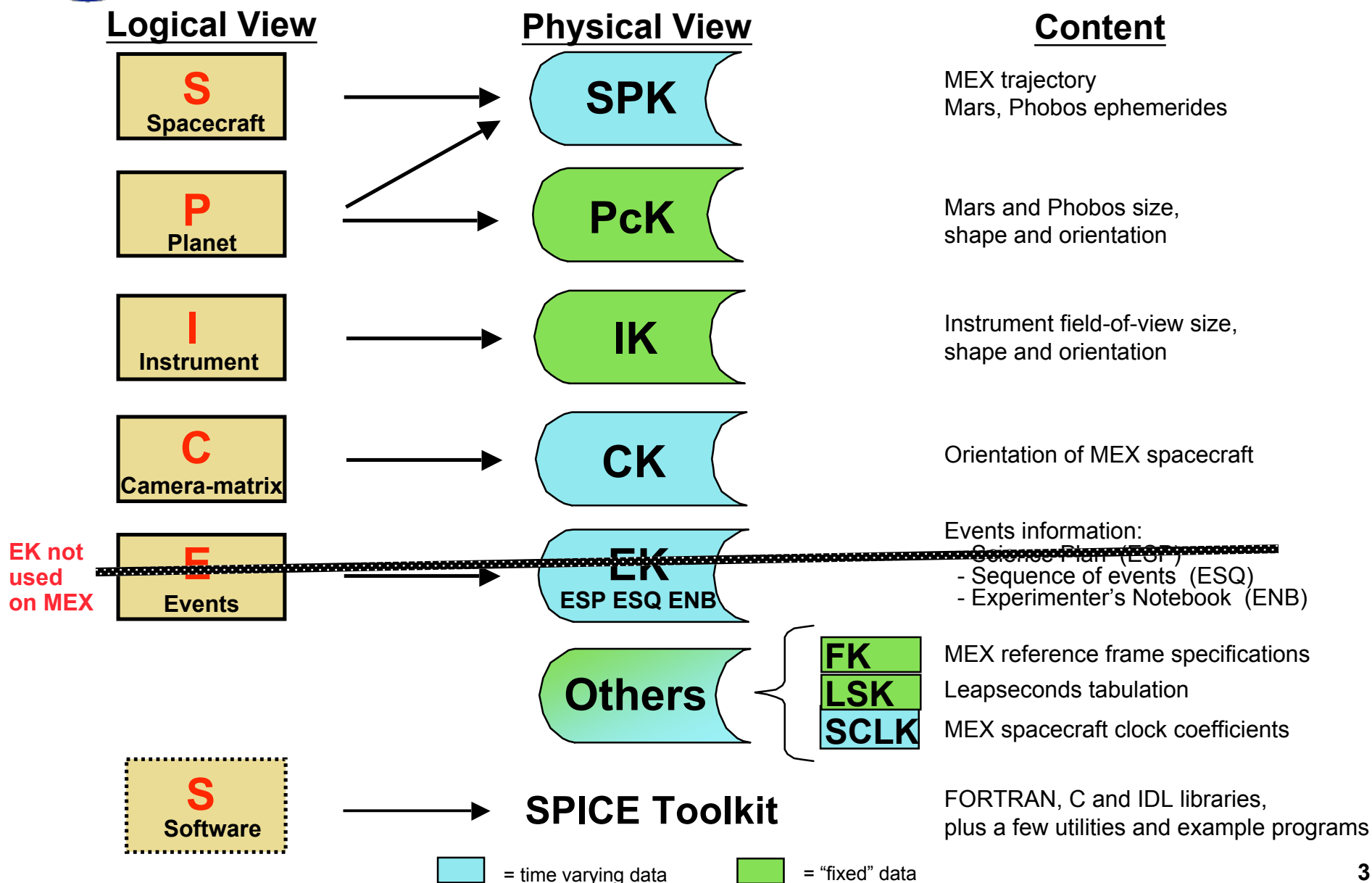


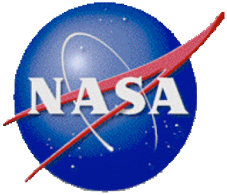
- **Since SPICE is used on NASA's Mars missions, you may freely acquire the same kind of data and use your same or similar SPICE-based tools to analyze the NASA data, or to compare or correlate NASA and MEX data.**



What Kinds of MEX SPICE Data Exist?

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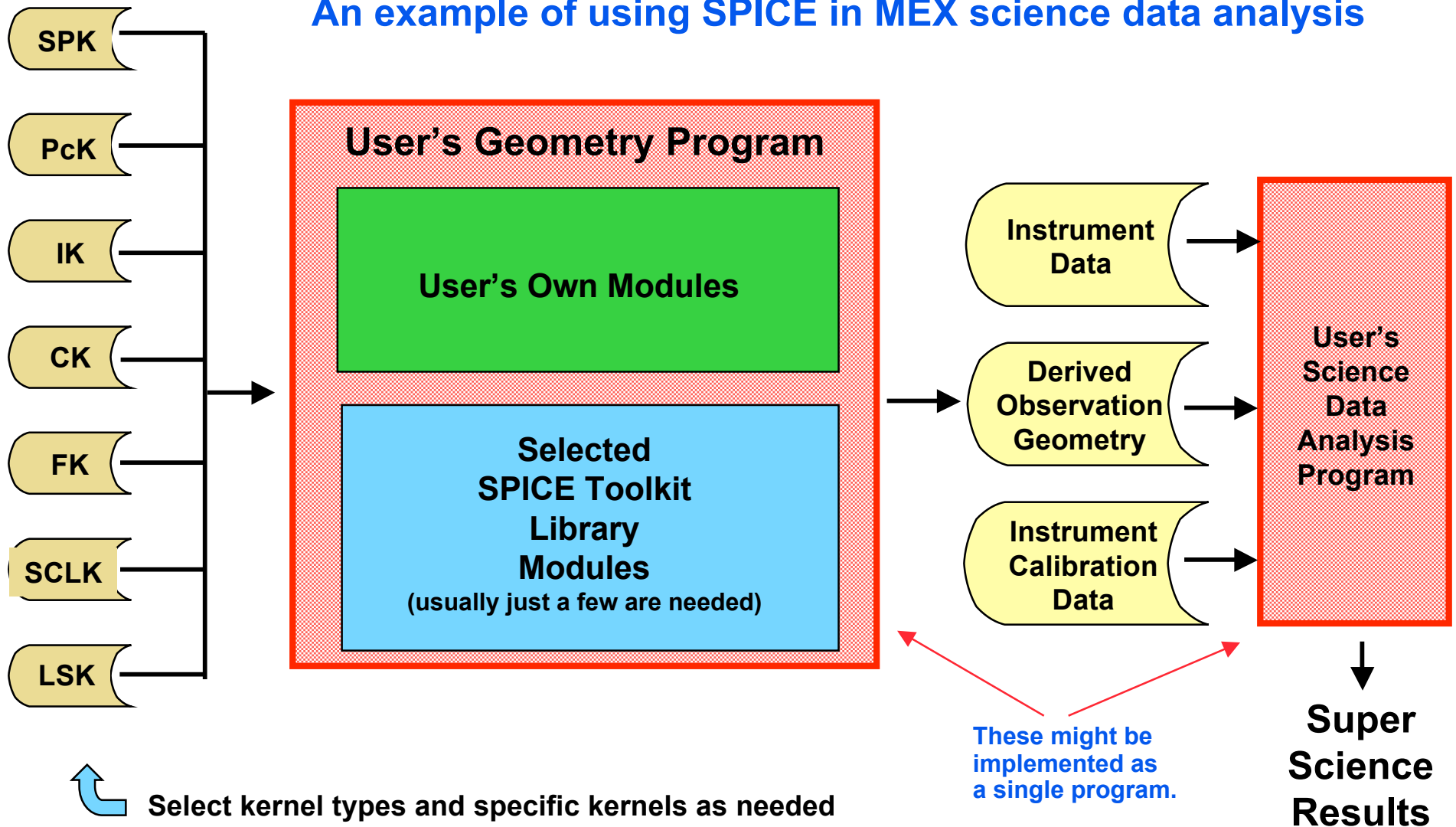


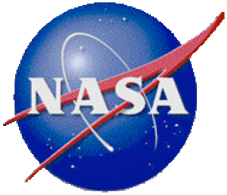


How To Use SPICE Data

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An example of using SPICE in MEX science data analysis



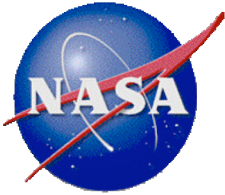


Kinds of Geometric Quantities That May Be Computed Using SPICE

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A few examples of what can be computed using SPICE kernel files and SPICE Toolkit software.

- **Positions and velocities, in any of many different reference frames and coordinate systems**
- **Instrument pointing direction, and intercept point on Mars (if there is one)**
- **Instrument footprint on Mars**
- **Lighting angles (phase, incidence and emission)**
- **Season (longitude of the sun)**
- **Local time on Mars**
- **Transformation matrices between “any” two reference frames**
- **Many kinds of time conversions**



Organization of MEX SPICE Data - 1

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Address: <ftp://solarsystem.estec.esa.nl/pub/projects/mex/data/spice/kernels/>

kernels

== WELCOME TO THE ARCHIVE OF RSSD DIVISION ==

Local time is: Tue Feb 15 21:10:45 2005

Remote access from: mac00357150214.jpl.nasa.gov

Login as: anonymous

Number of Users: 2

== For comments, please email to ftp@rssd.esa.int 23 Jan 2002 ==

Guest login ok, access restrictions apply.

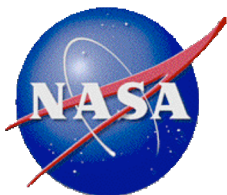
Path: [\[solarsystem.estec.esa.nl\]](#)[\[pub\]](#)[\[projects\]](#)[\[mex\]](#)[\[data\]](#)[\[spice\]](#)[\[kernels\]](#)

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ck	-	Folder	Wed, Feb 9, 2005, 12:57 PM
ek	-	Folder	Fri, Mar 15, 2002, 12:00 AM
fk	-	Folder	Thu, Nov 25, 2004, 10:22 AM
ik	-	Folder	Thu, Nov 25, 2004, 10:23 AM
lsk	-	Folder	Mon, Mar 22, 2004, 12:00 AM
orbnum	-	Folder	Wed, Feb 9, 2005, 7:39 PM
pck	-	Folder	Thu, Feb 10, 2005, 11:58 AM
sclk	-	Folder	Mon, Jan 31, 2005, 10:23 AM
spk	-	Folder	Wed, Feb 9, 2005, 1:26 PM

URL for ESTEC SPICE server

Description of file naming scheme

Sub-directories containing the various MEX SPICE kernels



Organization of MEX SPICE Data - 2

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spk

Back Forward Stop Refresh Home AutoFill Print Mail

Address: <ftp://solarsystem.estec.esa.nl/pub/projects/mex/data/spice/kernels/spk/>

NBS Website Inside JPL 1.0 NAIF NAIF - logs naif Planetary Data System Home Google CNN.com NBC 4 - Home weather.com Dictionary.com

spk

== WELCOME TO THE ARCHIVE OF RSSD DIVISION ==

Local time is: Tue Feb 15 22:00:22 2005

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Number of Users: 2

== For comments, please email to ftp@rssd.esa.int 23 Jan 2002 ==

Guest login ok, access restrictions apply.

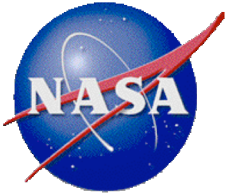
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BEAGLE2_SAMPLE_V3.BSP	6K	Document	Sun, Oct 5, 2003, 12:00 AM
DE405S.BSP	1,389K	Document	Mon, Jul 16, 2001, 12:00 AM
EARTHSTNS_FX_040916.BSP	36K	Document	Wed, Nov 10, 2004, 4:01 PM
EARTHSTNS_ITRF93_040916.BSP	34K	Document	Wed, Nov 10, 2004, 4:01 PM
MAR033_2000-2025.BSP	20,740K	Document	Fri, Mar 15, 2002, 12:00 AM
MEX_ASPIRA_STRUCT_V11.BSP	23K	Document	Thu, Dec 18, 2003, 12:00 AM
NEW_NORCIA.BSP	7K	Document	Mon, Oct 18, 2004, 2:18 PM
ORHM_00038.BSP	1,023K	Document	Thu, Aug 19, 2004, 12:00 AM
ORMF_00093.BSP	162,342K	Document	Mon, Oct 25, 2004, 4:38 PM
ORMM_031222180906_00052.BSP	11,034K	Document	Tue, Feb 10, 2004, 12:00 AM
ORMM_040201000000_00060.BSP	12,306K	Document	Mon, Mar 8, 2004, 12:00 AM
ORMM_040301000000_00068.BSP	12,899K	Document	Wed, Apr 14, 2004, 12:00 AM
ORMM_040401000000_00072.BSP	12,480K	Document	Wed, May 12, 2004, 12:00 AM
ORMM_040501000000_00076.BSP	8,929K	Document	Tue, Jun 8, 2004, 12:00 AM
ORMM_040601000000_00080.BSP	7,439K	Document	Wed, Jul 7, 2004, 12:00 AM
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ORMM_040901000000_00091.BSP	8,038K	Document	Thu, Oct 14, 2004, 5:51 PM
ORMM_041001000000_00096.BSP	7,681K	Document	Wed, Nov 10, 2004, 12:55 PM
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ORMM_050101000000_00109.BSP	7,883K	Document	Wed, Feb 9, 2005, 1:14 PM
ORMM_050201000000_00109.BSP	6,288K	Document	Wed, Feb 9, 2005, 1:25 PM
aareadme.txt	8K	ASCII Text	Wed, Nov 10, 2004, 4:01 PM

Typical kernel sub-directory, this one for spacecraft trajectory and planet/sun ephemerides.

The various trajectory/ephemeris data files available.

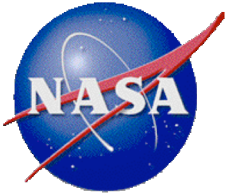
"aareadme" contains information about the kernels in this sub-directory.



Access to SPICE Products

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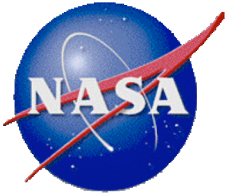
- **ESTEC SPICE server for Mars Express**
 - <ftp://solarsystem.estec.esa.nl/pub/projects/mex/data/spice/>
 - There exists an email list for notification of new SPICE kernels availability. Contact Jorge Diaz ([jdiaz\(a\)rssd.esa.int](mailto:jdiaz(a)rssd.esa.int)) to sign up.
- **Portal to SPICE information and products for many missions, located at NASA/JPL**
 - NAIF home page
 - » <http://naif.jpl.nasa.gov>
 - SPICE Toolkit: for all supported computing environments
 - » <http://naif.jpl.nasa.gov/naif/toolkit.html>
 - SPICE data: for missions and generic types
 - » <http://naif.jpl.nasa.gov/naif/data.html>
 - SPICE tutorials
 - » <http://naif.jpl.nasa.gov/naif/tutorials.html>
 - SPICE programming lessons
 - » ftp://naif.jpl.nasa.gov/pub/naif/toolkit_docs/Lessons/



The SPICE Toolkit

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- **The SPICE Toolkit is available in ANSI FORTRAN 77, ANSI C, and Interactive Data Language (IDL).**
- **The SPICE Toolkit is available for “all” popular computing environments.**
 - See NAIF web pages for details.
- **The SPICE Toolkit has been well tested on all supported platforms.**
- **The SPICE Toolkit is very stable.**
 - NAIF does not take away or change any functionality.
- **The SPICE Toolkit is offered free to individual scientists.**



SPICE Training

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- **A free SPICE training class will be held at ESTEC during April 11-15.**
 - The agenda consists of:
 - » Presentation and discussion of SPICE tutorials
 - » Guided hands-on programming lessons using exercises in FORTRAN, C and IDL
 - Contact Joe Zender ([Joe.Zender\(a\)esa.int](mailto:Joe.Zender(a)esa.int)) or Jorge Diaz ([jdiaz\(a\)rssd.esa.int](mailto:jdiaz(a)rssd.esa.int)) for details.