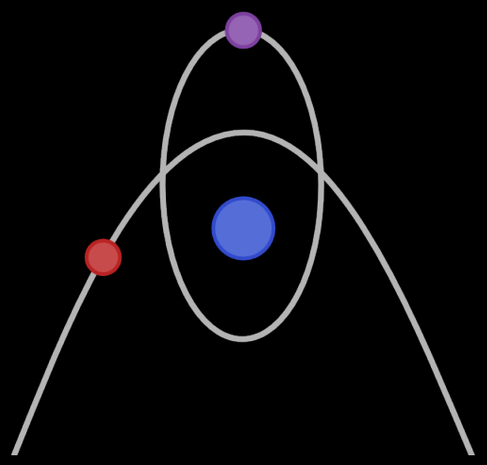


Astrodynamics.jl

MODERN SPACEFLIGHT DYNAMICS WITH JULIA

HELGE EICHHORN – JULIACON 2016

TECHNISCHE
UNIVERSITÄT
DARMSTADT

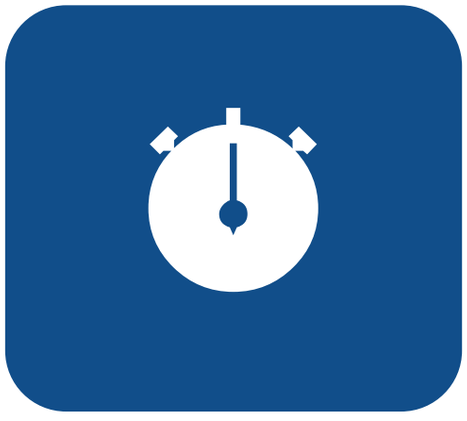
esa

esoc

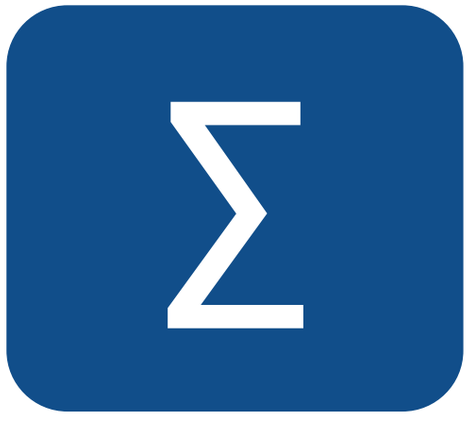
european space
operations center

https://github.com/helgee/juliacon-2016

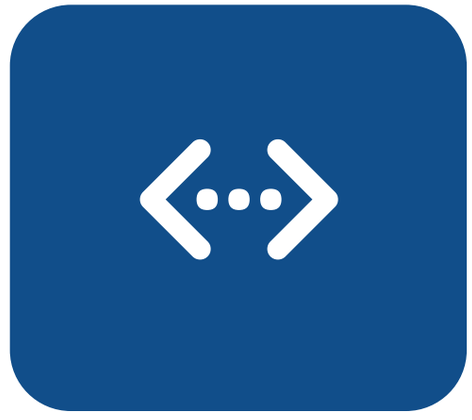
THE PERFECT LANGUAGE FOR ASTRODYNAMICS



Performance



Math Syntax



Legacy Code Support

Fortran 77!?

1970

Computing costs are the limiting factor

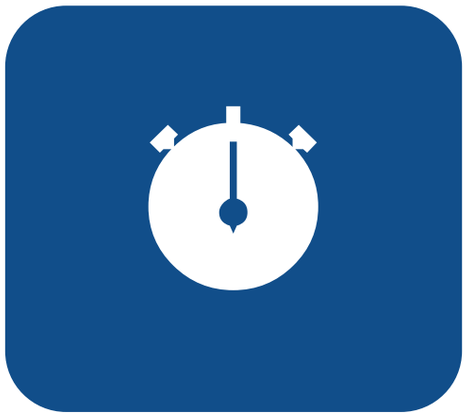
Efficiency is most important

Cannot have both?

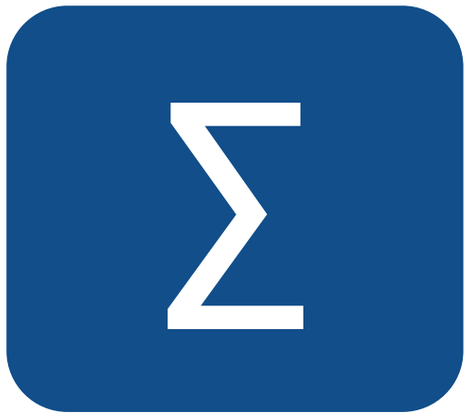
2016

Personnel costs are the limiting factor

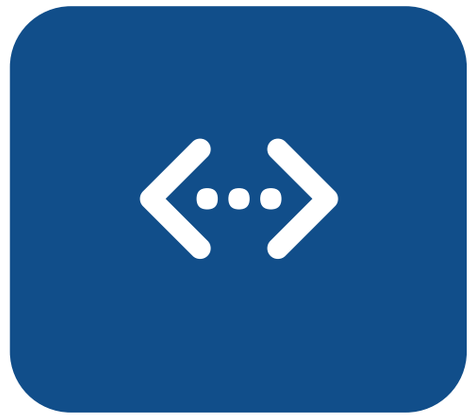
Usability should be most important



Performance



Math Syntax



Legacy Code Support

Visualization

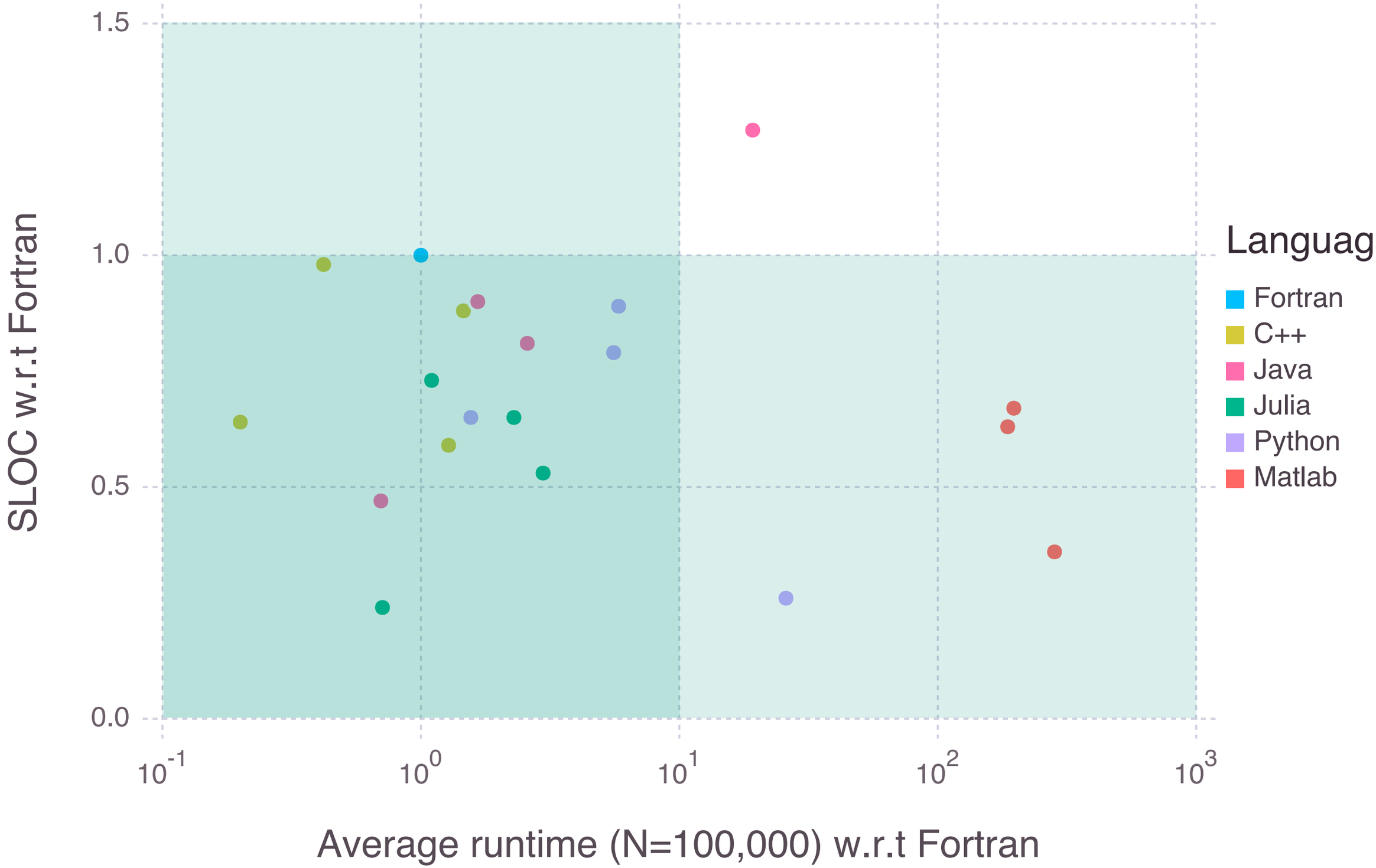
Developer Productivity

Native Parallelism

MICROBENCHMARKS

1. Calculating the Keplerian orbital elements
2. Solving Kepler's equation
3. Solving Lambert's problem
4. Calling the DOP853 Fortran 77 code

Fortran 2008, C++14, Java 8,
Matlab 2015b, Python 3.5, Julia 0.5


1.5
1.0
0.5
0.0
SLOC w.r.t Fortran
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}
Average runtime (N=100,000) w.r.t Fortran
Languages
Fortran
C++
Java
Julia
Python
Matlab

JPLEphemeris.jl

https://github.com/helgee/JPLEphemeris.jl

Dopri.jl

https://github.com/helgee/Dopri.jl

Astrodynamics.jl

https://github.com/helgee/Astrodynamics.jl

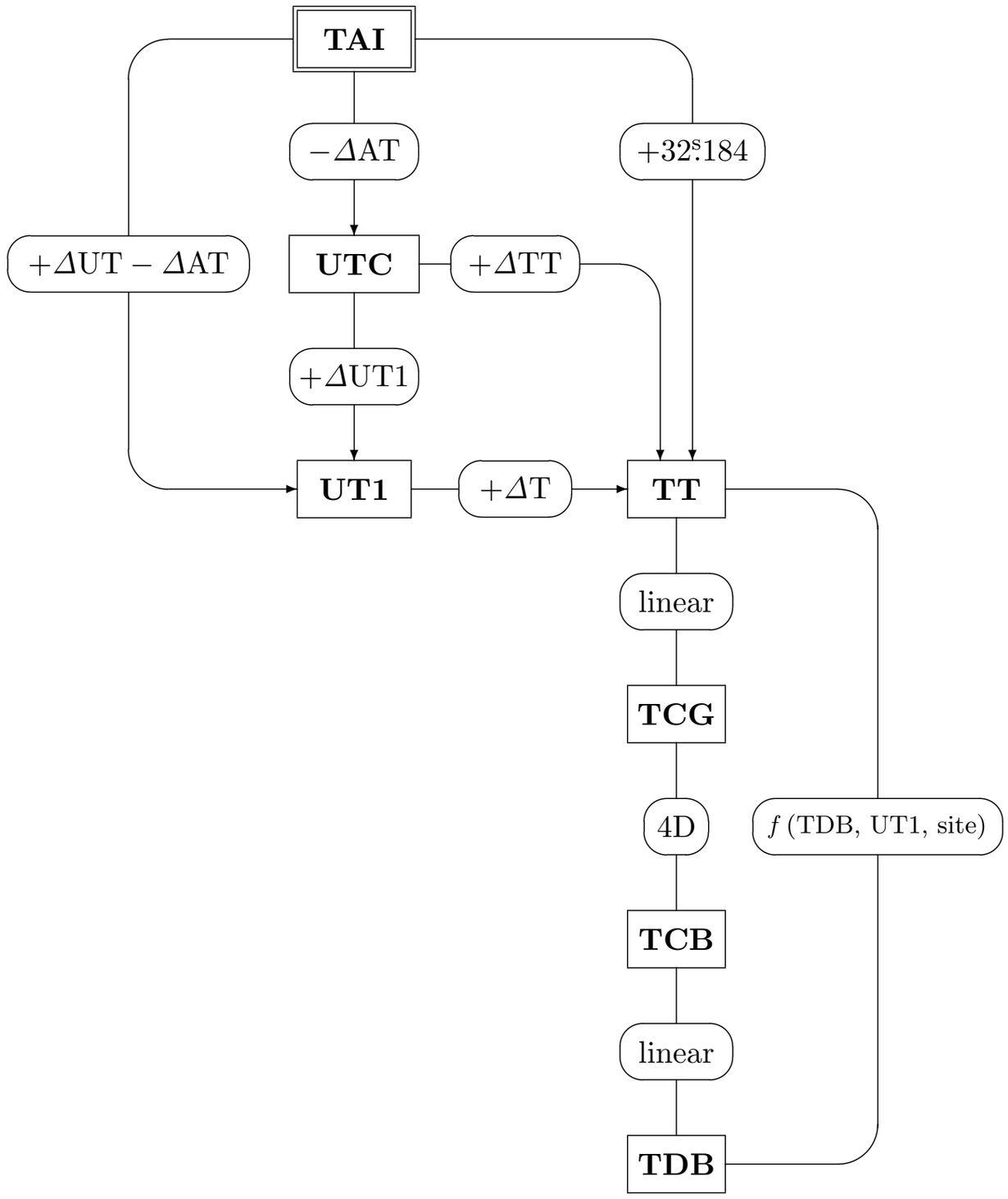
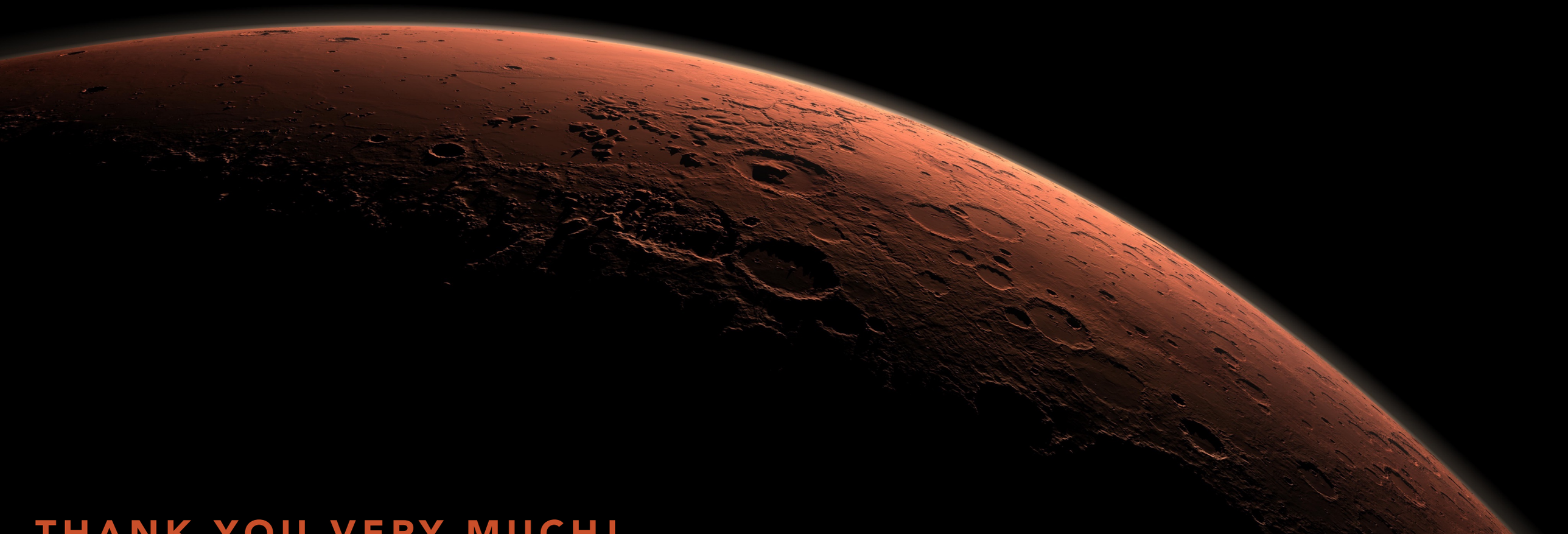


IMAGE SOURCE: IAU SOFA TIMESCALE AND CALENDAR TOOLS

1.0



THANK YOU VERY MUCH!