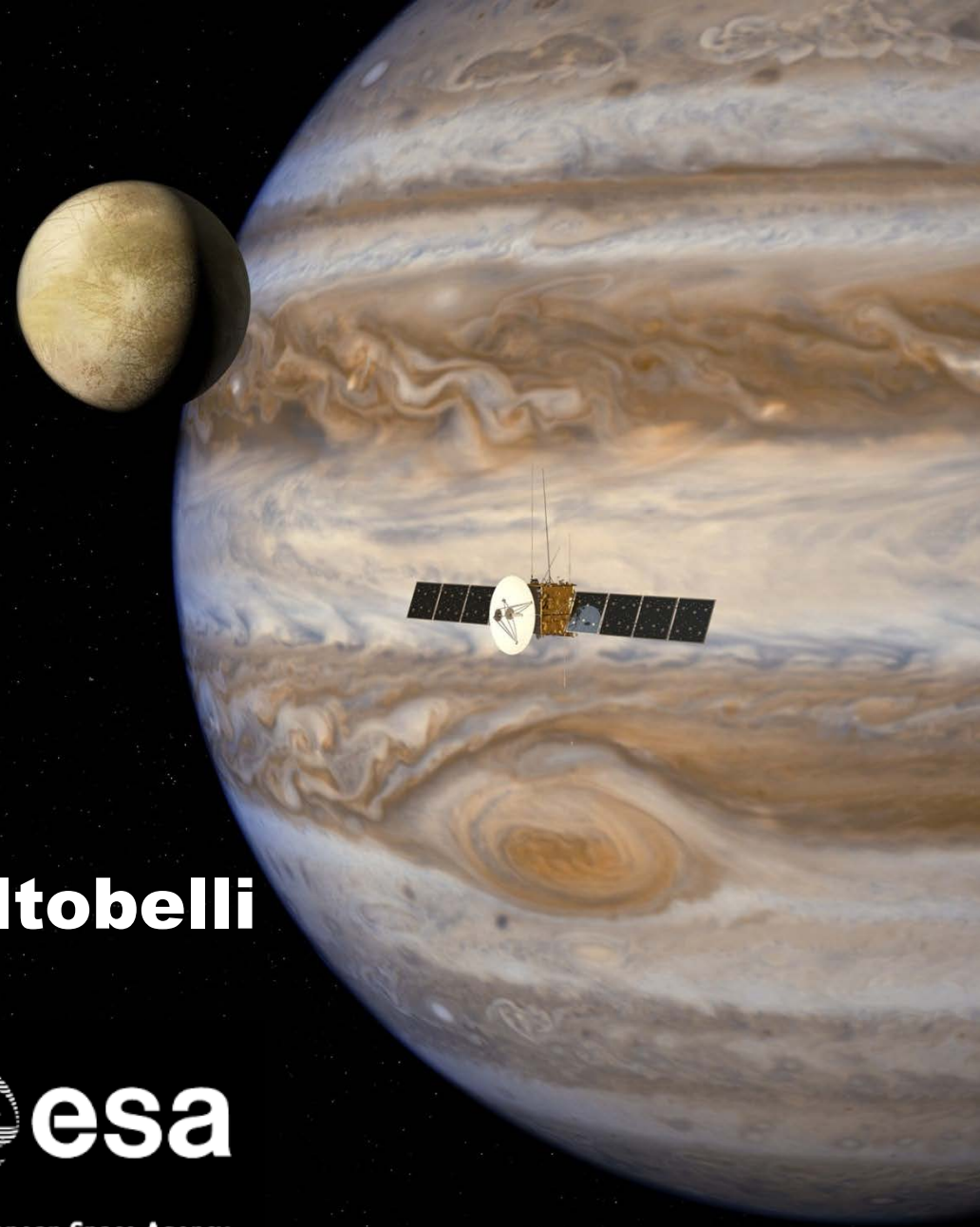
JUpiter Icy Moons Explorer (JUICE)

Status report for OPAG

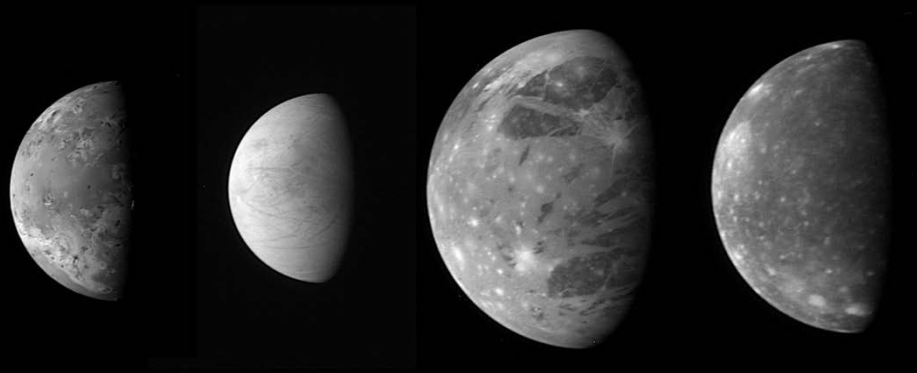
O. Witasse and N. Altobelli



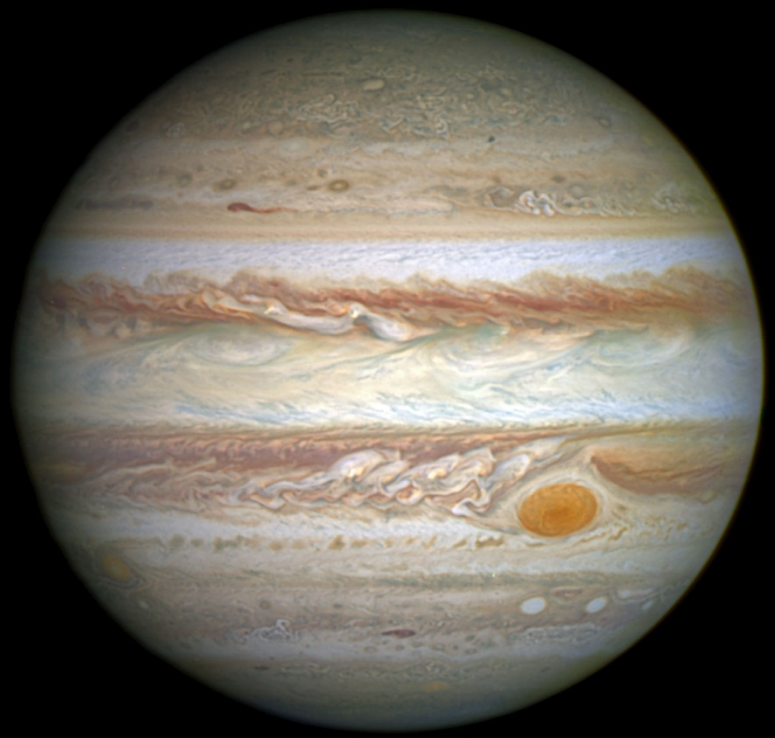
JUICE artist impression (Credits ESA, AOES)

European Space Agency
Agence spatiale européenne

Jupiter Icy Moons Explorer



Io Europa Ganymede Callisto



Emergence of habitable worlds around gas giants

Jupiter system as an archetype for gas giants

MISSION SCIENCE (1/3)

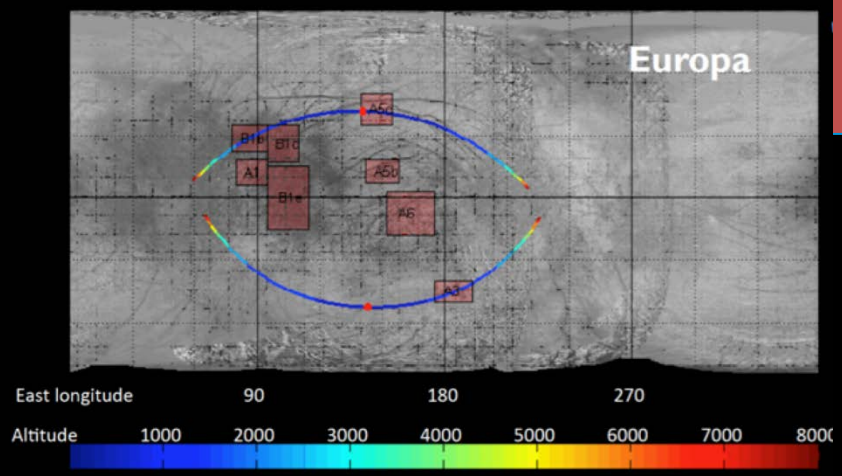
EXPLORATION OF HABITABLE WORLDS

- GANYMEDE
- EUROPA
- CALLISTO

EXPLORATION OF JUPITER SYSTEM

- ATMOSPHERE
- MAGNETOSPHERE
- IO, MINOR MOONS AND RINGS

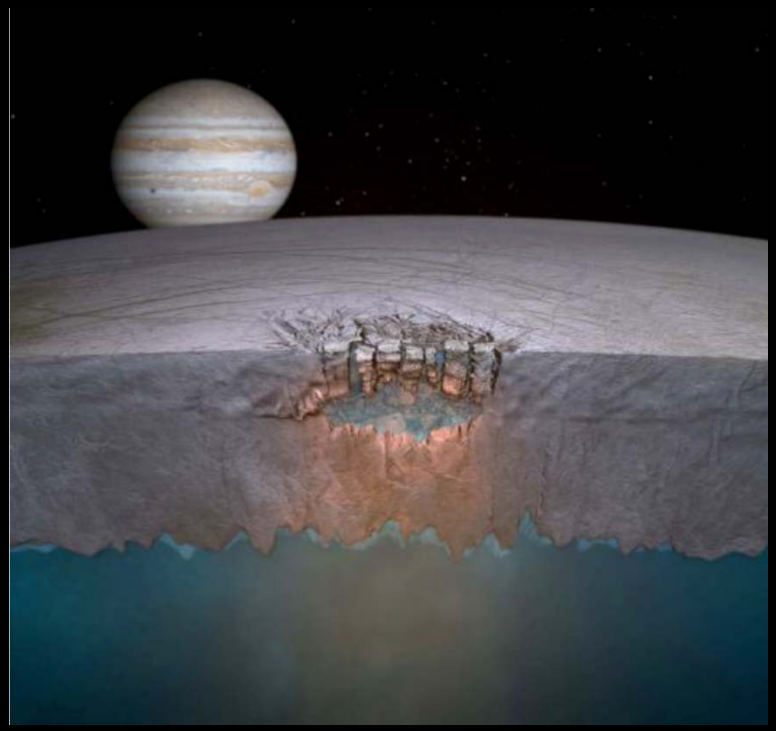
MISSION SCIENCE (2/3)

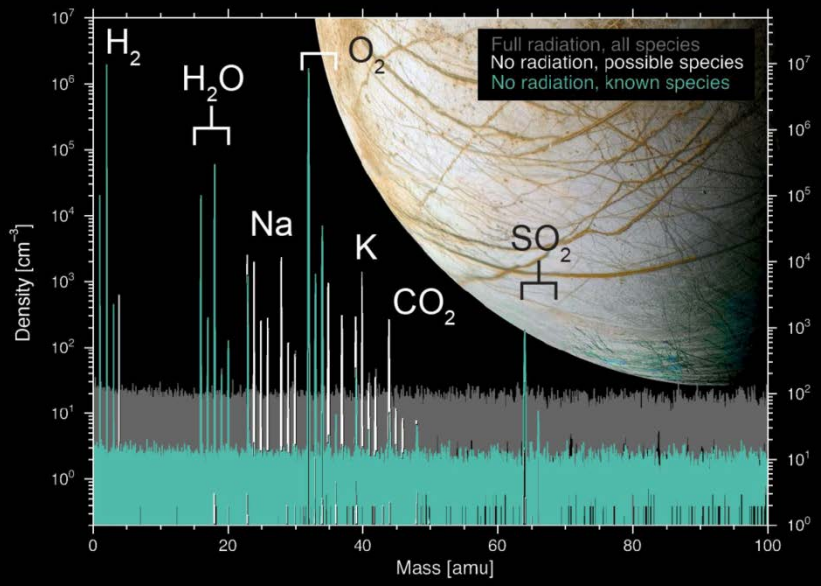


EXPLORATION OF HABITABLE WORLDS

Ganymede, Callisto, Europa

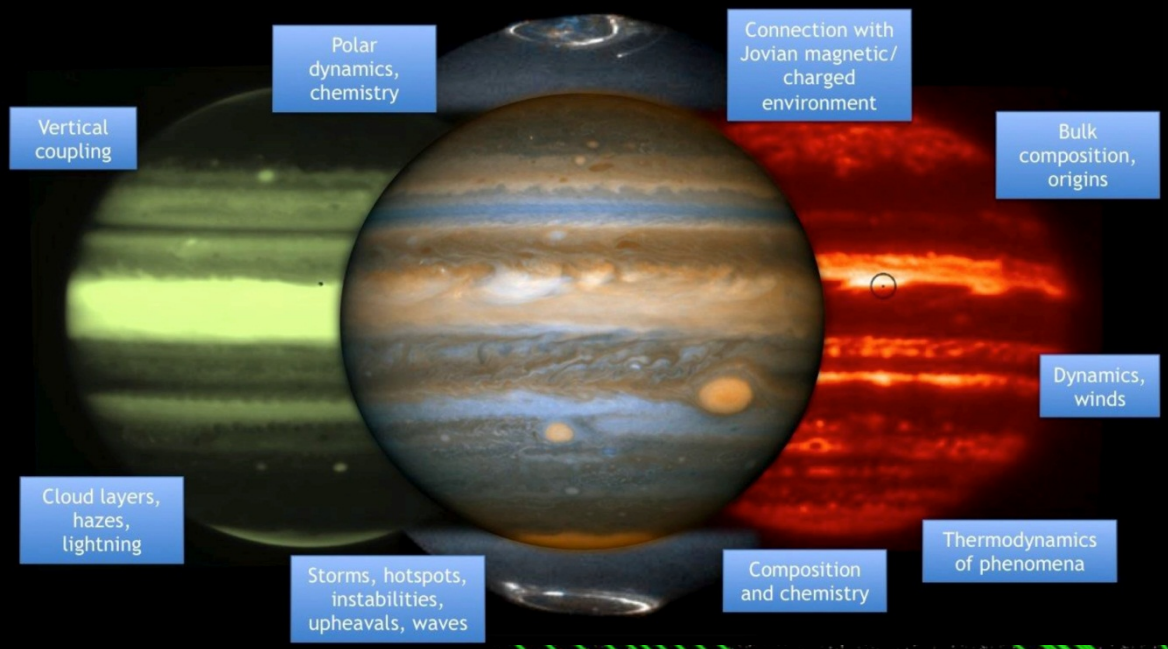
- **Ocean**
- **Ice shell**
- **Surface features and composition**
- **Activity**

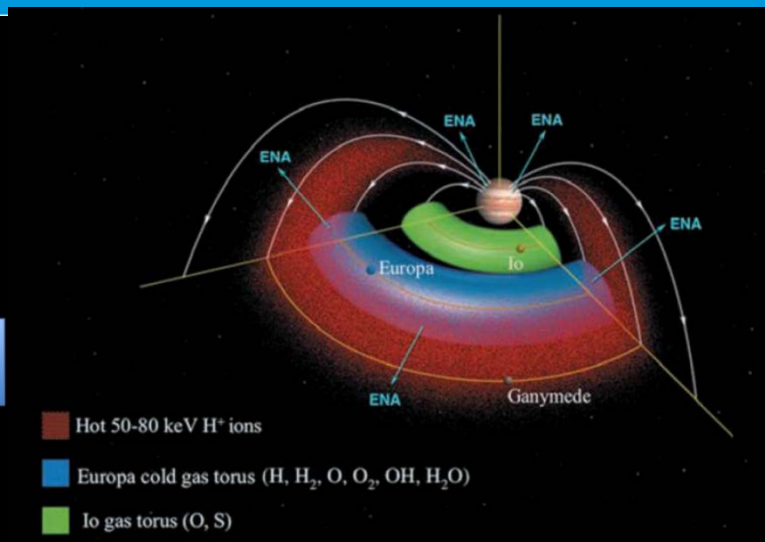




MISSION SCIENCE (3/3)

EXPLORATION OF THE JUPITER SYSTEM



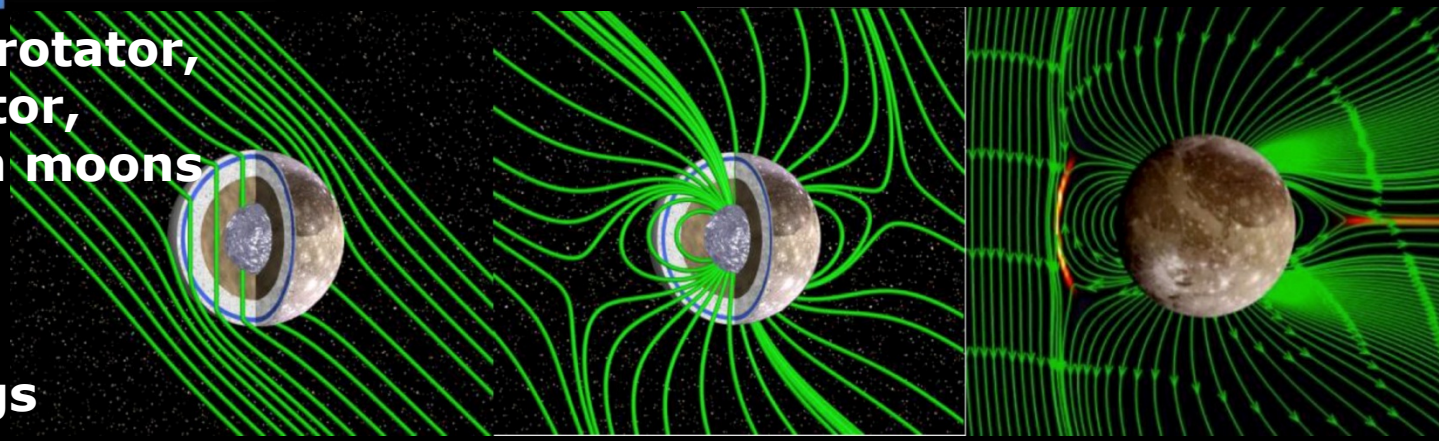


Atmosphere circulation, chemistry, structure

Jovian magnetic rotator,
Particle accelerator,
Interactions with moons

Io activity

Plasma, dust rings



Experiment teams

Acronym	Instrument	PI
JANUS	Camera	P. Palumbo (IT)
MAJIS	VNIR imaging spectrometer	Y. Langevin (F) and G. Piccioni (IT)
UVS	UV spectrograph	R. Gladstone (USA)
SWI	Sub-mm wave instrument	P. Hartogh (D)
GALA	Laser Altimeter	H. Hussmann (D)
RIME	Ice Penetrating Radar	L. Bruzzone (IT)
3GM	Radio-Science	L. Iess (IT)
PRIDE	VLBI	L. Gurvits (EU)
J-MAG	Magnetometer	M. Dougherty (UK)
PEP	Plasma Package	S. Barabash (S)
RPWI	Radio and Plasma wave instrument	J.-E. Wahlund (S)

Interdisciplinary Scientists

Leigh Fletcher	University of Leicester, UK	Jupiter's Climate Variability as the Archetype for Giant Planets
Olivier Grasset	University of Nantes, France	Deep Exploration of the Icy Moons, with a special focus at Ganymede
Norbert Krupp	Max-Planck Institute, Gottingen, Germany	Characterisation of the particles and fields parameters in the Jovian magnetosphere (globally and locally in the vicinity of the moons) and their temporal and spatial variability

Science Working Groups

Tasks:

- Scientific forum
- Definition of scientific operational scenarios

WGs #	Name
1	Internal structure, subsurface and geophysics of giant icy moons
2	Surfaces and near-surface exospheres of satellites, dust and rings
3	Jovian magnetosphere and plasma environment
4	Jupiter

Task Group

Satellites coordinate systems, cartography and nomenclature

Tasks:

- Longitude system for the Icy Satellites (East or West)
- New control point networks and controlled global mosaics for Europa, Ganymede, and Callisto as basis for the planning work
- Definition of the standards for the cartographic products of the JUICE mission

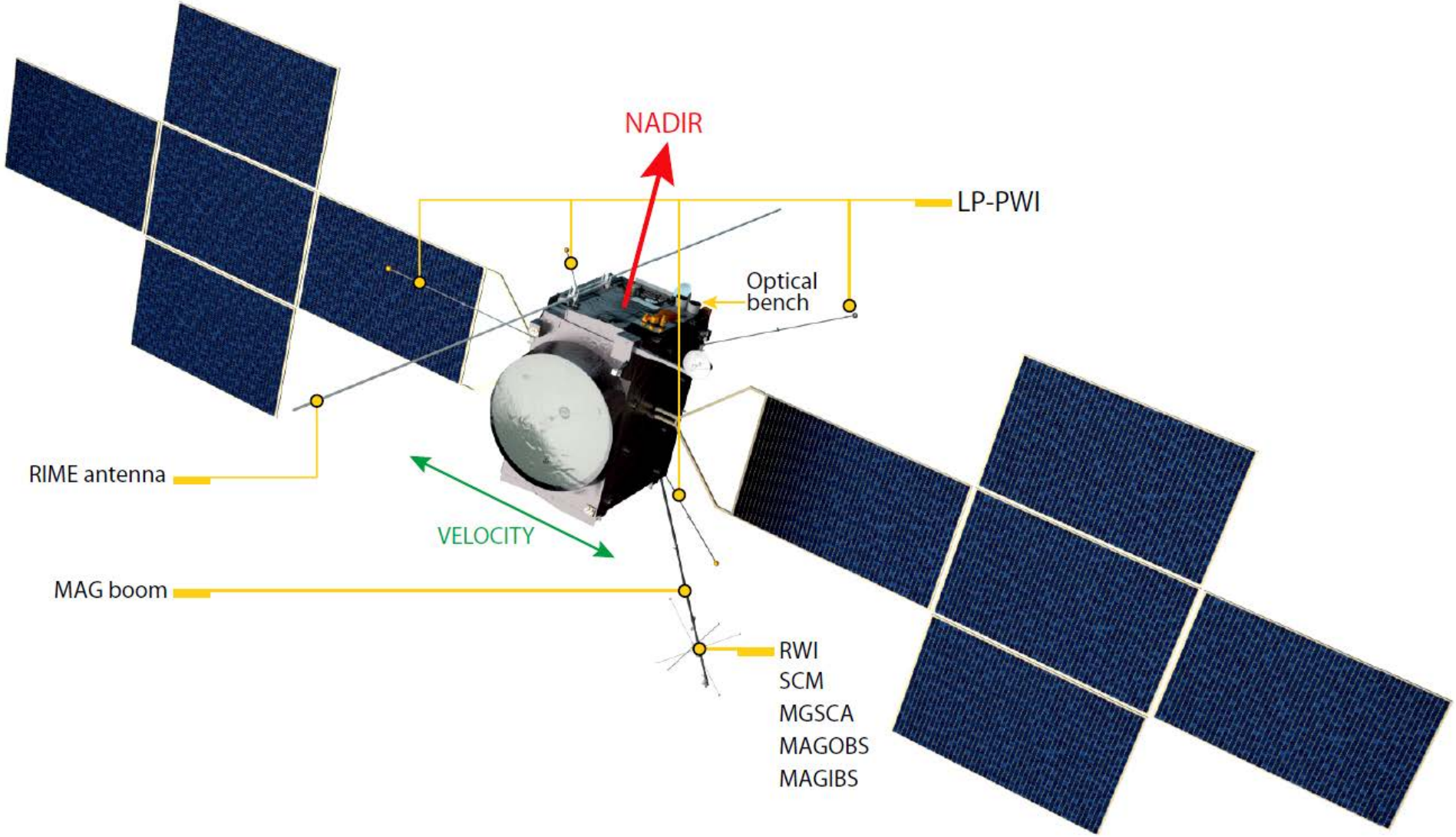
JUICE Spacecraft

- Prime industrial Contractor: Airbus Defence & Space (Toulouse, France)

- Selection and kick-off in July 2015

- Spacecraft:
  - 3-axis stabilised
  - Mass ~ 5 tons at launch, incl. ~ 2700 kg fuel
  - Solar array 97 m^2
  - Power at Jupiter ~ 850 W
  - Fixed High Gain Antenna (X, Ka Bands)
  - Steerable Medium Gain Antenna (X, Ka Bands)
  - Data Volume ~ 1.4 Gb per day

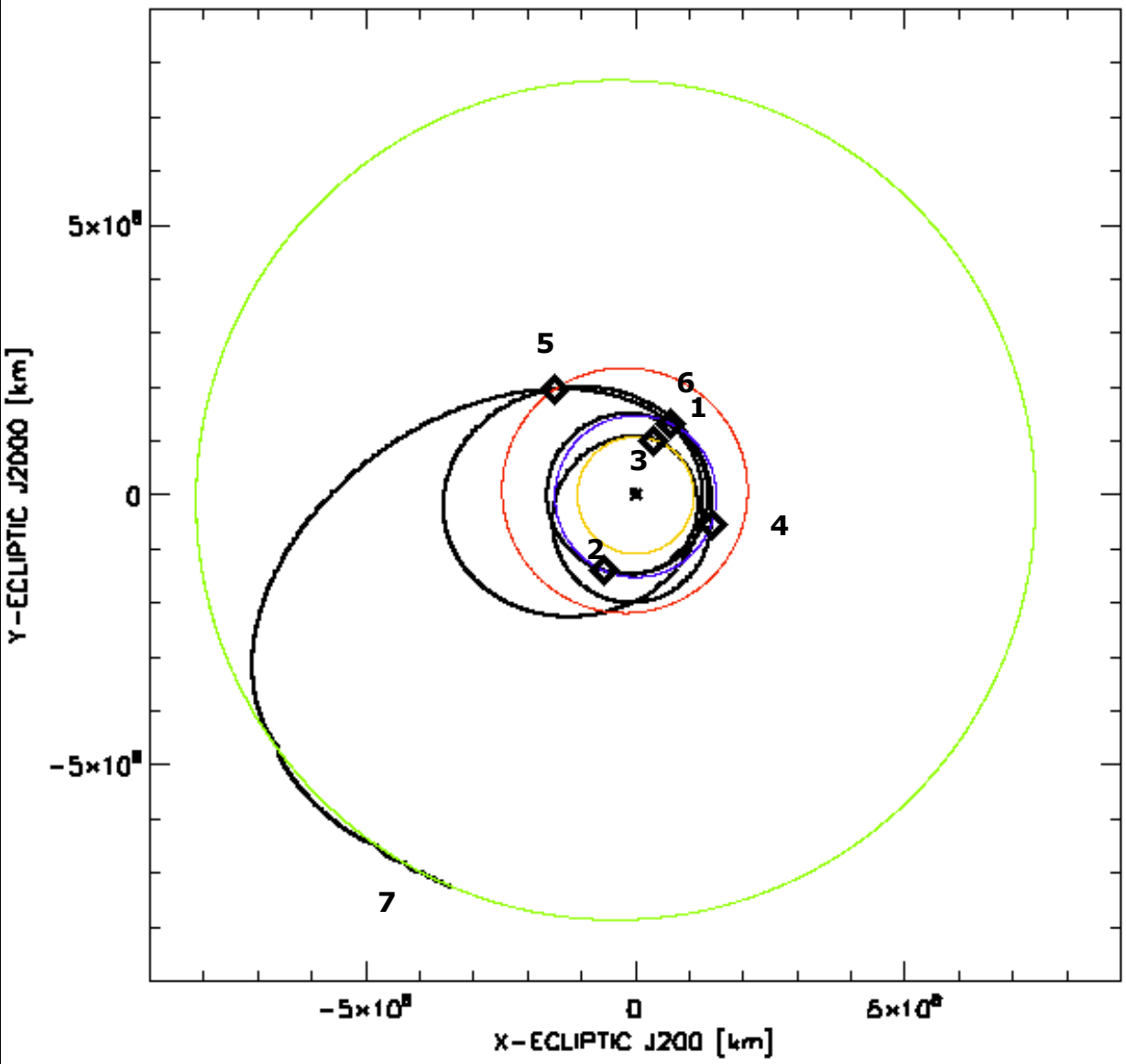
JUICE Spacecraft



Overall Mission Profile

Launch	June 2022
Interplanetary transfer (Earth-Venus-Earth-Mars-Earth)	7.6 years
Jupiter orbit insertion	October 2029
2 Europa flybys	October 2030
Jupiter high-latitude phase	December 2030-May 2031
Transfer to Ganymede	June 2031-July 2032
Ganymede orbit insertion	August 2032
Ganymede elliptical orbit/5000 km circular orbit	August-December 2032
Ganymede 500 km Circular Orbit	January-June 2033
End of mission	June 2033

Trajectory: Cruise Phase



EARTH ORBIT
VENUS ORBIT
MARS ORBIT
JUPITER ORBIT
JUICE TRAJECTORY

Flybys: 2023−150T20:34:17 earth12725 km

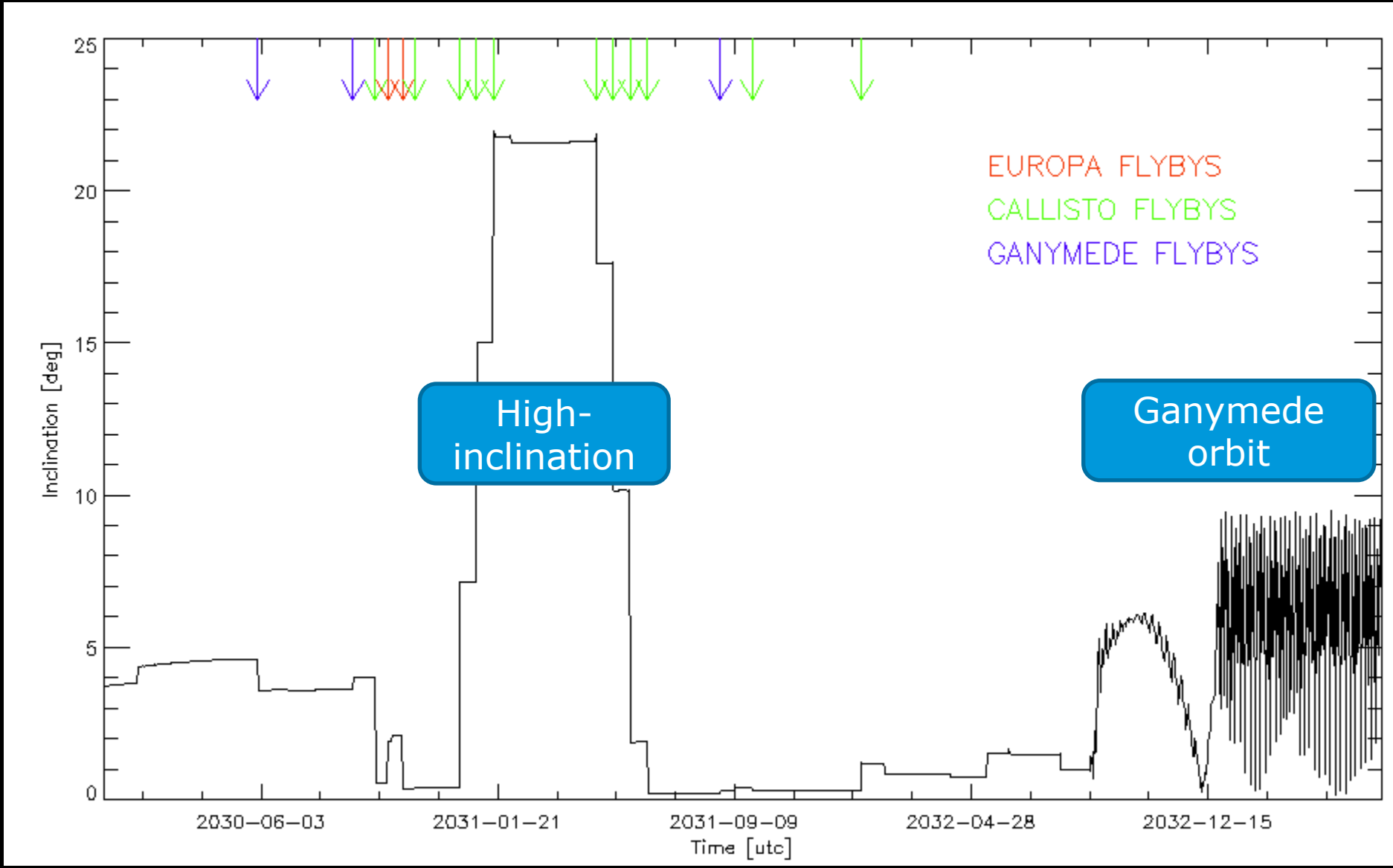
Flybys: 2023−295T14:22:33 venus 9538 km

Flybys: 2024−245T19:24:31 earth 1945 km

Flybys: 2025−041T17:57:47 mars 1118 km

Flybys: 2026−330T01:25:08 earth 3683 km

Trajectory: Orbit Inclination /Jupiter equator



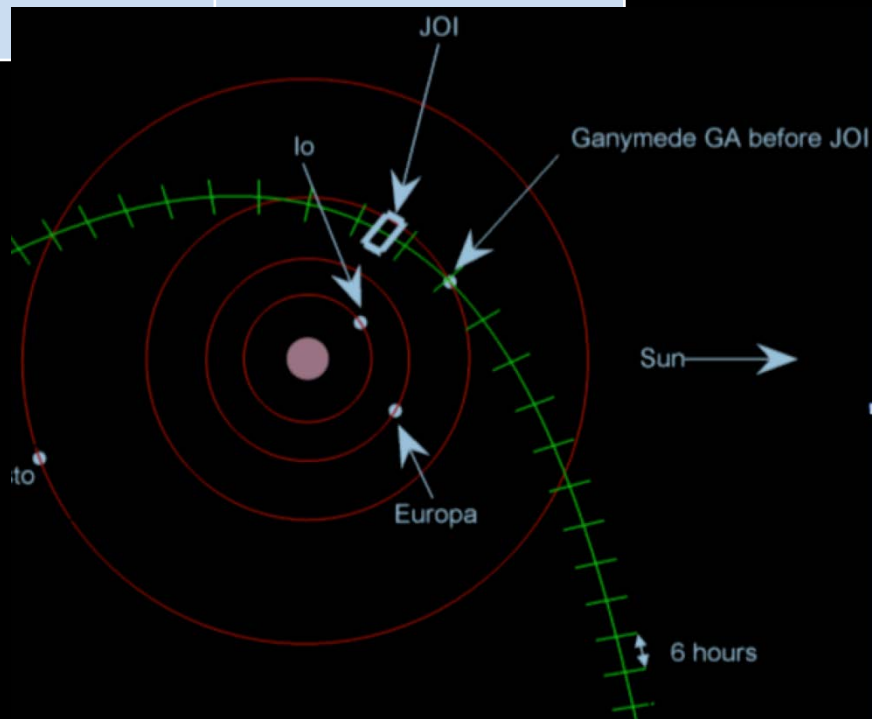
Close flybys (targeted)

Moon	Time [utc]	altitude [km]	solar phase angle [deg]
ganymede	2030 MAY 31	401.2008	59.700601
ganymede	2030 SEP 01	502.018	71.97997
callisto	2030 SEP 23	790.76668	101.60079
europa	2030 OCT 05	403.17724	65.403492
europa	2030 OCT 19	403.10471	66.370317
callisto	2030 OCT 31	409.41762	149.81345
callisto	2030 DEC 14	199.10038	115.61552
callisto	2030 DEC 31	199.10399	106.62542
callisto	2031 JAN 16	199.10008	116.22609
callisto	2031 APR 27	199.10058	97.717578
callisto	2031 MAY 13	199.10178	73.630589
callisto	2031 MAY 30	199.10021	82.144442
callisto	2031 JUN 16	199.10055	34.905334
ganymede	2031 AUG 26	806.84648	176.64201
callisto	2031 SEP 26	356.80365	123.77809
callisto	2032 JAN 11	786.69738	42.505276

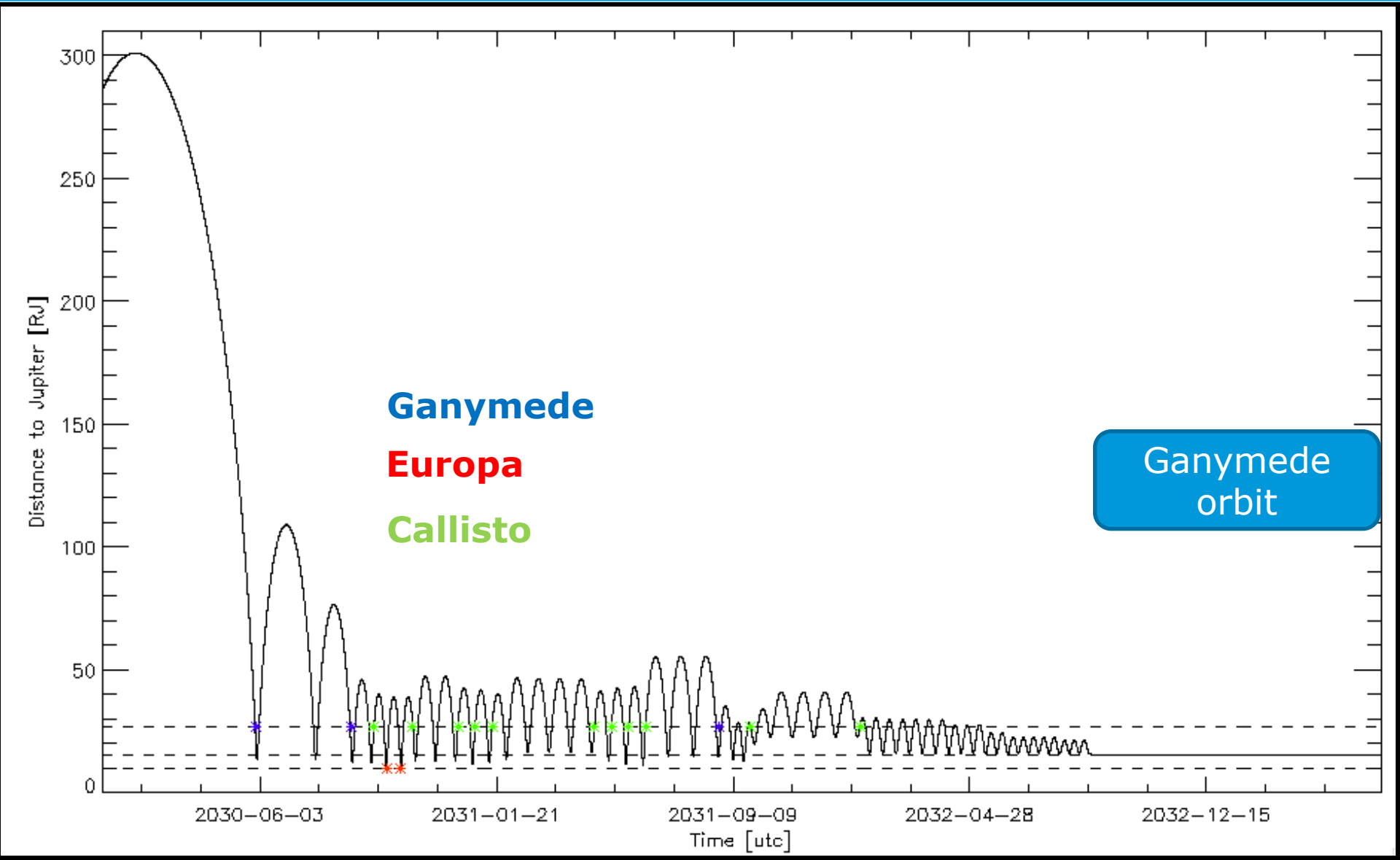
Closest approach to other moons

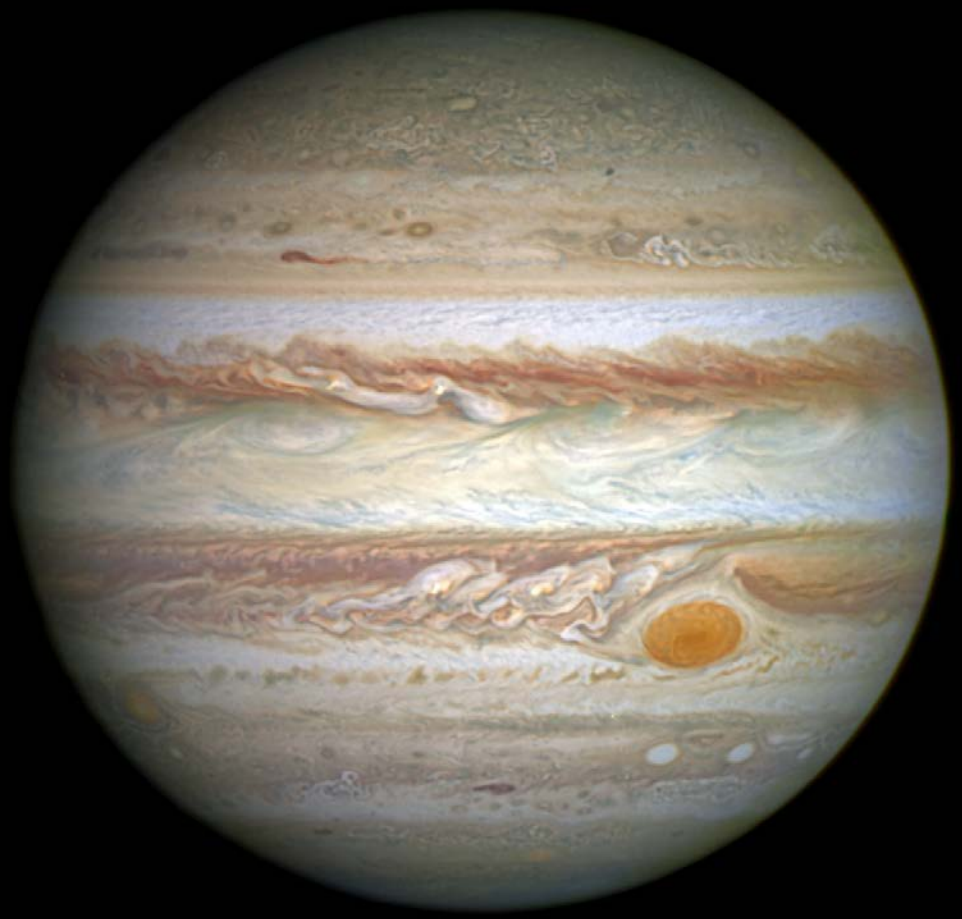
Moon	Time (utc)	Distance (km)	Phase (deg)
IO	2029-364T05:09	430666	134
AMALTHEA	2029-364T06:03	489786	134
THEBE	2029-364T11:01	448536	133.9

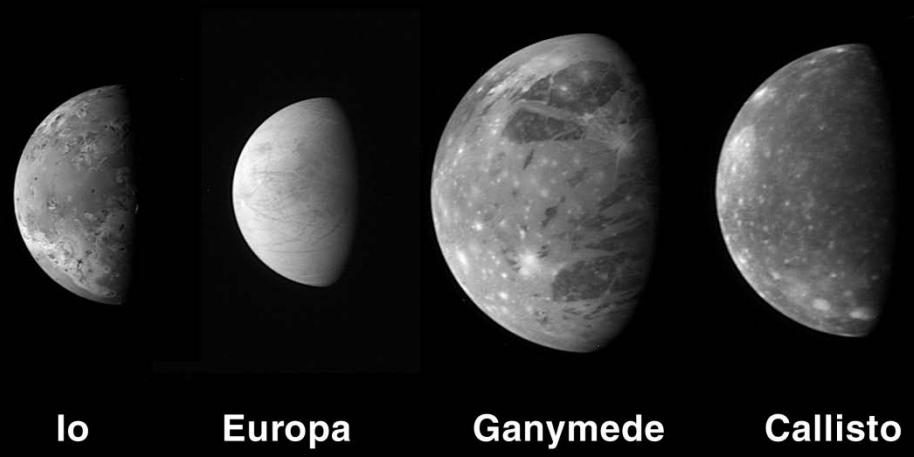
Encounters during JOI



Trajectory: Distances to Jupiter







Thank you for your attention
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