

Identified scientific tasks → N2 DWG 6+7

H. Lammer, F. Raulin, U. Motschmann, C. Szopa

DWG 6 → Astrobiology

- 1.) Carbon cycle on Titan → **Cassini/Huygens**
 - a.) Origin and release processes of methane in Titan's atmosphere
 - b.) Mechanisms of formation and properties of Titan's organic aerosols
- 2.) Martian surface, near-subsurface environment → **ExoMars, etc.**
 - a.) Source, nature and evolution of organics on the surface and near subsurface
 - b.) Environmental conditions: UV, energetic particles, oxidants
 - c.) Selection of landing sites of great astrobiological interest
- 3.) Astrobiology on Europa → **future Europa mission**
 - a.) Were the initial conditions on Europa favourable for the emergence of life (energy sources, liquid water and prebiotic matter)
 - b.) How can we detect bio-markers related to Europa's life if it exists?

DWG 6 → related laboratory and space based experiments

1.) Carbon cycle on Titan

a.) Experimental determination of constants in Titan-like environmental conditions → input for theoretical models

PALMS, Rennes, France → determination of rate constants related to photochemical modelling

IPC-PAS Warsaw, Poland; LISA, Paris, France; LPPM, Orsay, France; Bessy Synchrotron, Berlin, Germany → spectroscopic data related to photochemistry

→ DWG3+5: DWG 1: LPG, Nantes, France

b.) Experimental determination of physical and chemical properties of Titan's aerosol analogues

SA, Paris; LISA, Paris; ENSCP, Paris; LPG, Grenoble; LPG, Nantes; CETP, Paris; France; Open University, UK; IWF, Graz, Austria; Italian team related to radar spectroscopy

Note: SA & LISA can provide analogues for experimental determination

DWG 6 → related laboratory and space based experiments

2.) Martian surface and subsurface environment

- a.) Experimental determination of the evolution of organics under Martian environmental conditions

LISA, SA, Paris, France; Leiden University; The Netherlands, DLR, Cologne, Germany; CAB, Madrid, Spain; IWF, Graz, Austria

- b.) Experiments related to the diffusion of oxidants into the Martian soil and resistance of biological matter to Martian conditions

CBM, Orleans, INRA, Paris, IJM, Paris, France; DLR, Cologne; HAS, Budapest, Hungary; IWF, Graz, Austria; Salzburg, University, Salzburg, Austria; Aarhus, University, Denmark; Leiden University, The Netherlands; CAB, Spain; Open University, UK

DWG 6 → related laboratory and space based experiments

3.) Astrobiology on Europa

a.) Hydrothermal vents in situ and in the lab as possible experimental model for Europa's oceans

CBM, Orléans; Univ. Brest ; LISA, Paris; LPG, Nantes; SRSN, Poitiers, France ; Stockholm University, Sweden

b.) Search for bio-markers, from terrestrial analogues

Open University, UK; IWF, Graz; Univ. Salzburg, Austria; CAB, Madrid, Spain; CBM, Orléans; Univ. Orsay, France

c.) Spectroscopic and particle detection of bio-markers from orbiters [particles] Univ. Bern, Switzerland; [modelling] IWF, Graz, Austria; other institutions ? → **DWG 3**

DWG 7 → Exoplanets → precursor planetary science for Darwin, etc.

Questions related to the evolution of habitable planets / atmospheres / water

- 1.) Stellar/solar (dense) plasma interaction of atmospheres of terrestrial (Earth-like) exoplanets with weak magnetic fields (Venus, Mars): many tidal-locked exoplanets are expected to have weak magnetic moments
 - Stellar/solar wind plasma interaction with Earth/Venus-like planets in the early stage. Applications of hybrid models to heated (X-ray and EUV) extended/evaporating neutral atmospheres → related to early Venus, Mars, Earth, Titan (DWG1, DWG2)
- 2.) Tidal-locked exoplanets (related to Venus and Titan → terrestrial exoplanets)
 - Generation of magnetic dynamos → what are the necessary conditions for the generation of magnetic dynamos on Earth-like planets (difference between Venus, Earth and Mars), water, plate tectonics, rotation, etc. → expertise from DWG 8 is needed
 - Applications of GCMs to tidal-locked (Venus, Titan) exoplanets with CO₂ and N₂ atmospheres with different atmospheric densities → expertise from DWG1 is needed

3.) Dust in extrasolar systems and planet formation → exozodies, formation of terrestrial planets **DWG4+9 and link to N3**

DWG 7 → Exoplanets → **CoRoT, ground-based observations (N3), etc.**

1.) Stellar magnetospheric-atmospheric interaction of “hot Jupiter's”

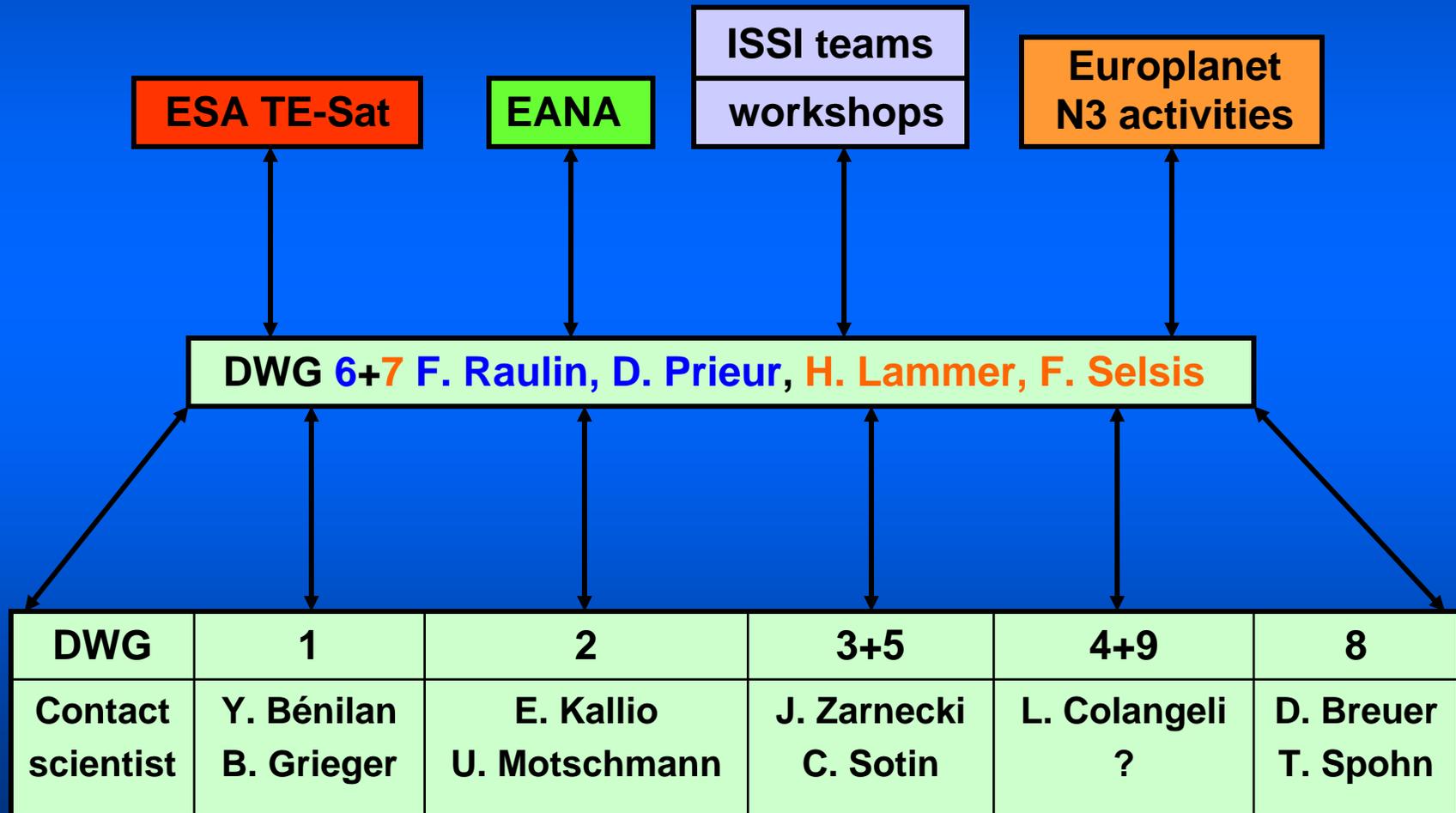
- Study of radio emission mechanism depending of the stellar and planetary parameters → **related to research on Jupiter (DWG2)**
- Modelling of mass-loss evolutionary scenarios, for determining mass-radius relations as a function of orbital distance → **related to blow-off phases of young Venus, Earth, Titan, etc. (DWG1)**

Website → links to relevant sites related to astrobiology (DWG6) and exoplanet research (DWG7) in Europe, like exoplanets encyclopaedia – statistics, new discoveries (J. Schneider), - relevant papers, . . .

External expert (exoplanets DWG7 → atmospheric evolution link to DWG1):

Yuri N. Kulikov, PGI, Russian Academy of Science, Murmansk, Russian Federation

Transpersonal structure: 4 key people related to DWG 6+7 and representatives of astrobiology and exoplanets in each N2 DWG



DWG 6

Targets

Exoplanets	?	??	??	??	??
Titan	?		?	??	
small bodies			?		
Europa	?	?	?	?	?
Mars		?	?	?	?
Earth					

Liquid H2O Organic evolution Prerequisite for life emergence Life emergence Habitability

■ Present ■ Past ■ Indirect contribution

DWG 7

Targets

Terrestrial exoplanets
Darwin
etc.

Stellar wind (CME) plasma interaction with weak magnetic Earth-like exoplanets as function of orbital distances

Thermal and non-thermal loss processes related to change in atmospheric composition, thermospheric X-ray and EUV heating related to star type

Tidal-locked planets → application of GCM's, dynamo generation (necessary conditions)

Effects of atmospheric changes on bio-markers → expected spectra

Hot Jupiter's
CoRoT
etc.

Dust in extrasolar systems → exozodies, planet formation

Evaporation of "Hot Jupiter" atmospheres → mass-radius relation

Stellar plasma interaction of "Hot Jupiter's" → generation of EM emission and interaction between planet and star

DWG 1+2

DWG 1+2+8

DWG 1+6

DWG 4+9 } **N3**

DWG 1

DWG 2 } **N3**

Tasks