Proposta di aggiornamento del Documento di Visione Strategica (DVS): linee di pensiero del CS

## M. Branchesi per il Consiglio Scientifico - INAF





- Il DVS dell'INAF indica le priorità di lungo termine (su scala decennale) per l'Ente
- Si collega alle roadmap scientifiche definite a livello internazionale nell'ambito dell'astrofisica e dell'astroparticle e alle priorità del programma scientifico delle agenzie spaziali
- Il Piano Triennale di Attività (PTA) fornisce il quadro dei progetti e programmi di ricerca dell'Ente che sono attualmente svolti e che si prevede di sviluppare nei prossimi anni
- Il PTA si prefigge di programmare l'attività scientifica e tecnologica, e di implementare le linee di priorità definite dal DVS nel breve termine



## Ultimo DVS 2019-2028



**INAF Strategic Vision** 

June 2019

## **INAF Strategic Vision**

Redatto da:

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## DVS 2019-2028

### **Executive Summary**

### **Top priority undertakings**

"not intended as the only goals that INAF should pursue in the future, but as goals that are of special relevance and should not be missed"

### 1) Participation to the large international facilities of the future



A number of major international facilities are considered as top priorities for the scientific and technological investment by INAF. They are: **SKA, ELT, Euclid, Athena and CTA** 

#### Recommendations

- support and enlarge the involved communities in all the relevant aspects, from technological development, to data analysis/archiving and theoretical interpretation
- strong participation to "precursor" programs/facilities developing the skills and gathering the ancillary data



### 2) The exploration of the Solar System

In a nearer future instead we will see an in-deep exploration of bodies like Mercury, Mars, Jupiter satellites and the Sun, performed by the missions **BepiColombo, Exomars, Juice and Solar Orbiter**.

### Recommendations

### Support for data exploitation?

- encourage and support INAF researchers in their efforts to assume a leadership role in the pre-launch and in the post-launch phases
- provide adequate resources to the laboratory and theoretical activities necessary for an optimal exploitation of the data.



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### 3) Life beyond our Solar System

Exoplanetary astrophysics with a broad, multi-technique portfolio of ground- and spacebased programs across a wide range of wavelengths

Over the next 10-15 years, complete characterization (occurrence rates, internal and atmospheric composition) of exoplanets in the solar neighborhood, with the goal of identifying biomarkers in the atmospheres of temperate Earth-type planets

#### Recommendations

Consolidate INAF participation, produce increasing efforts (at all levels) to secure key, leadership roles in the projects at the forefront in exoplanetary science

#### 2019

#### 4) Multimessenger Astrophysics

Feld that will become more and more important in the next decade

#### Recommendations

- Keep a high profile international role in multi-messenger astrophysics increasing level of effort and resources.
- Support the aspects that are more relevant for the experience of the INAF scientists (e.g. electromagnetic follow-up, theoretical astrophysics, development of new facilities/ satellites for e.m. observations)
- adequate resources devoted to support the technological, observational and theoretical activities



#### 4) Multimessenger Astrophysics

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- adequate resources devoted to support the technological, observational and theoretical activities

### 5) Fundamental (Astro)physics

### INFN-Lab?

Decisive progress will be made in the next decade towards solving problems of Dark Matter and Dark Energy. Astrophysics is in the unique position to gather information with many types of cosmological probes over a wide range of scales and cosmic time

### Recommendations

- interdisciplinary studies which requires deep synergy with the direct search of the dark matter and other particles carried out in ground-based laboratories,
- need adequate resources and large partnerships

### **General Recommendations**

### **Support to Theoretical Astrophysics**

- Theorists more and more engaged with current datasets, planning new facilities, missions and in computational approaches
- Every participation to a new project or facility should involve a commensurate number of theorists and interpretative astrophysicists to maximize the scientific return
- INAF should set up a specific program to support Theoretical Astrophy Example: GRAWITA

## lbased on GRB and SN Encourage coordination and creation of large group communities)

Promote the coordination of individual research homogeneous fields in order to optimize resourd

### Support "Basic Research" projects

- support scientific and technological projects small in size but with important scientific return, as well as curiosity driven research.
- regular emission of competitive calls for scientific and technological research projects.



Progetti trasversali

tra RSN?

rtant scientific

esearch projects.

### **General Recommendations**

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### **Encourage coordination and creation of large groups**

Promote the coordination of individual researchers and communities working in similar/ homogeneous fields in order to optimize resources and form groups with ``critical mass''.

### Support "Basic Research" projects

- Finanziamento per support scientific and technological projects small in l'Astrofisica return, as well as curiosity driven research. Fondamentale
- regular emission of competitive calls for science



### **General Recommendations**

#### **Foster interdisciplinary partnerships**

foster interdependence across astronomy and other disciplines, such as chemistry, geology, biology, and computer science.

#### Improve the cooperation with ASI

Space missions are a fundamental component of modern research in Astrophysics, a more strict cooperation between INAF and the Italian Space Agency



### **Structure/Table of Contents**

Introduction

**Executive Summary** 

Acronyms

Major challenges in Astrophysics over the next decade

- 1) Solar, interplanetary and magnetospheric physics
- 2) The Solar System
- 3) Extrasolar Planetary Systems
- 4) Star Formation (local and global)
- 5) Stellar Evolution
- 6) Relativistic astrophysics and astroparticles
- 7) The Milky Way and the Local Group
- 8) Formation and Evolution of Galaxies and Cosmic Structures
- 9) Cosmology and Fundamental Physics
- 10) Enabling Technologies

The Project-Question-Method Matrix



INAF Strategic Vision

2019



DVS 2019-2028



INAF Strategic Vision

EXAMPLE

## DVS 2019-2028

### **Structure/Table of Contents**



# Each sections from 1 to 9 a summary Table (Key Question Method Project)

/	Key Question	Method	Project
	Formation and evolution of sub-galactic structures in the Milky Way and the Local Volume	Detailed study of our Galaxy and nearby galaxies, mapping 3D spatial distribution and structure, kinematics, metallicity, abundances, and ages. Theoretical modelling. General relativity.	Gaia, Gaia-ESO, APOGEE1/2, GALAH WEAVE, MOONS 4MOST, ELT, Pan- STARRS, LSST, Kepler, Euclid, THEIA, HST, JWST, WFIRST, HPC
	The chemo-dynamical evolution of star clusters in galaxies	Large, unbiased samples of clusters (open, globular) and of their population studied with accurate, precise photometry, astrometry, spectroscopy. Models of cluster formation, evolution, dissolution.	Gaia, Gaia-ESO, WEAVE, MOONS, 4MOST, GIARPS, CRIRES+, ESPRESSO, ELT (HIRES & MOS), HPC, Pan-STARRS, LSST
	The star formation history (SFH) in the	Use large scale galactic and extragalactic surveys	OGLE, J-PAS, Pan- STARRS, Gaia,

### **Structure/Table of Contents**

The Project-Question-Method Matrix: one table grouping questions and methods as a function of the projects

Appendix 1.	1 Projects	with a significant	future technological	involvement of INAF
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Project	Key Question	Method	Future INAF technological contribution
SKA	Processes that determined the formation and evolution of the Solar System	Observations of primitive bodies, exoplanetary systems (dust aggregation processes, formation processes)	Antenna systems Heat rejecter Phased Array Feeds Front end optical transmitter and receiver Analogue fiber optical RF/ RFoF UAV
	Proto-planetary discs: initial conditions for the formation of	Formation and evolution of disks: solids from dust to planets, gas content,	

Appendix 1.2 Projects without a significant future technological involvement of INAF

Project	Key Question	Method
VLA, ASKAP, MeerKAT	Origin and evolution of galaxies	Observations of molecular gas Non thermal processes in cosmic structures
	Global star formation properties	Non thermal processes, emission from radio jets,

## AGGIORNAMENTO del DVS 2024-2033 a cura del CS

- Ci baseremo sul precedente DVS mantenendo testo, struttura e impostazione;
- Aggiorneremo il testo in base agli sviluppi e scoperte scientifiche più recenti;
- Aggiungeremo tematiche innovative e fortemente emergenti;
- Il DVS conterrà le grandi linee della ricerca INAF, le loro prospettive di sviluppo e le priorità anche in relazione alle strategie scientifiche emergenti nel contesto internazionale



Roadmap 2020-2030 for European Astronomy Science Vision & Infrastructure



**Mid-term review** 







### **Decadal Surveys**



## AGGIORNAMENTO del DVS 2024-2033 a cura del CS

Nell'ottica dell'aggiornamento del DVS il CS ha individuato alcune tematiche/aree innovative, emergenti e in crescita che non sono state o sono state parzialmente menzionate nel precedente DVS



Discussione con la comunità moderata dal CS



## AGGIORNAMENTO del DVS 2024-2033 a cura del CS



Vogliamo che le giornate INAF siano un evento:

- per raccogliere e valutare input per l'update del DVS
- per discutere e proporre tematiche che siano di forte rilevanza, nuove sfide, opportunità e prospettive per il futuro rispetto al precedente DVS
- per far emergere altri punti di vista

