

LA FISICA DI STAR TREK

Viaggi nel tempo, motore a curvatura, teletrasporto...
La scienza incontra il futuro!



Fabio Peri

CIVICO PLANETARIO “ULRICO HOEPLI”

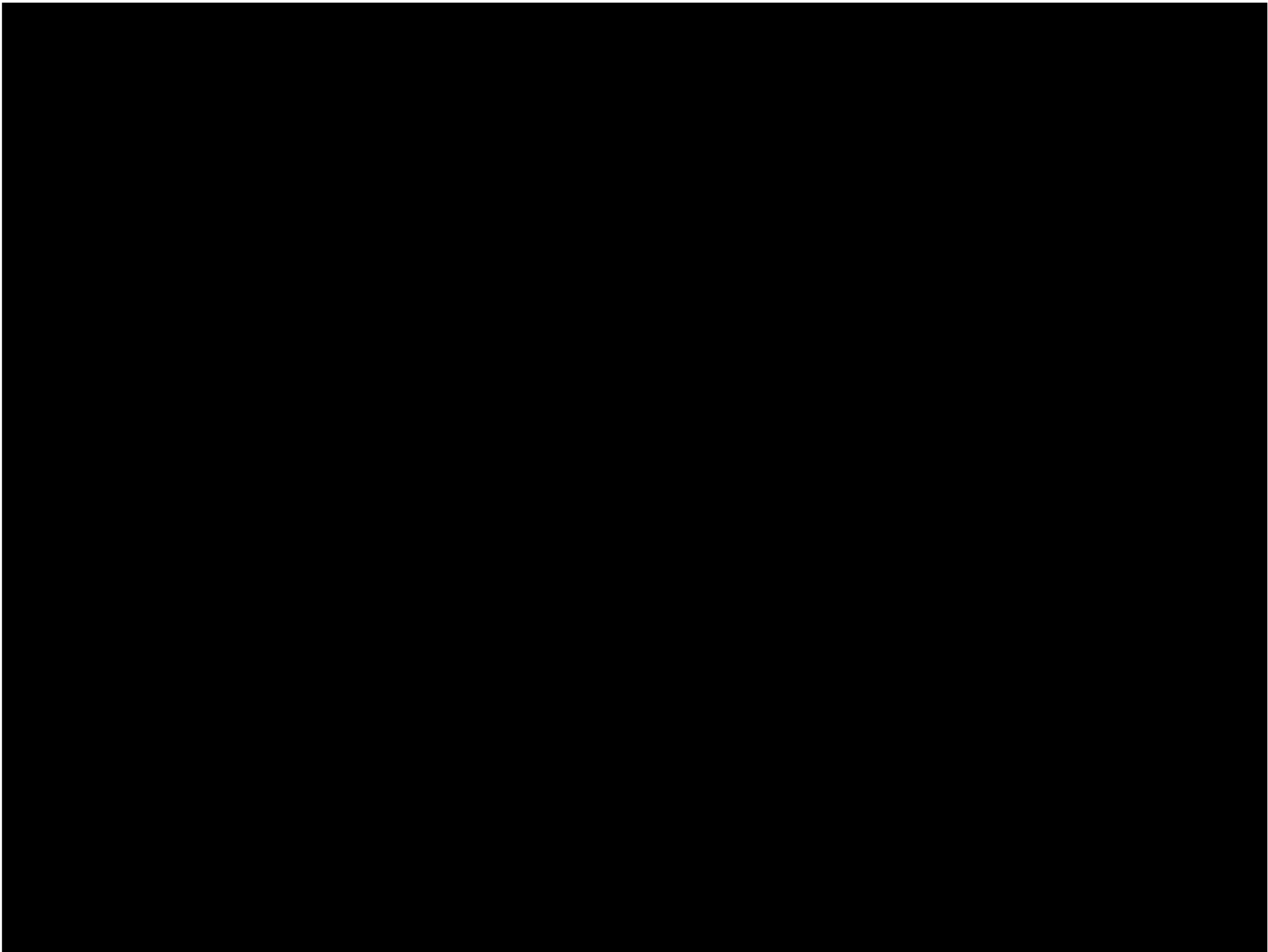




www.comune.milano.it/planetario

Corso Venezia, 57 - 20121 Milano
MM1 P.ta Venezia - tram 9, 29 o 30
Passante ferroviario P.ta Venezia













Viaggiare più veloci della luce



Velocità warp

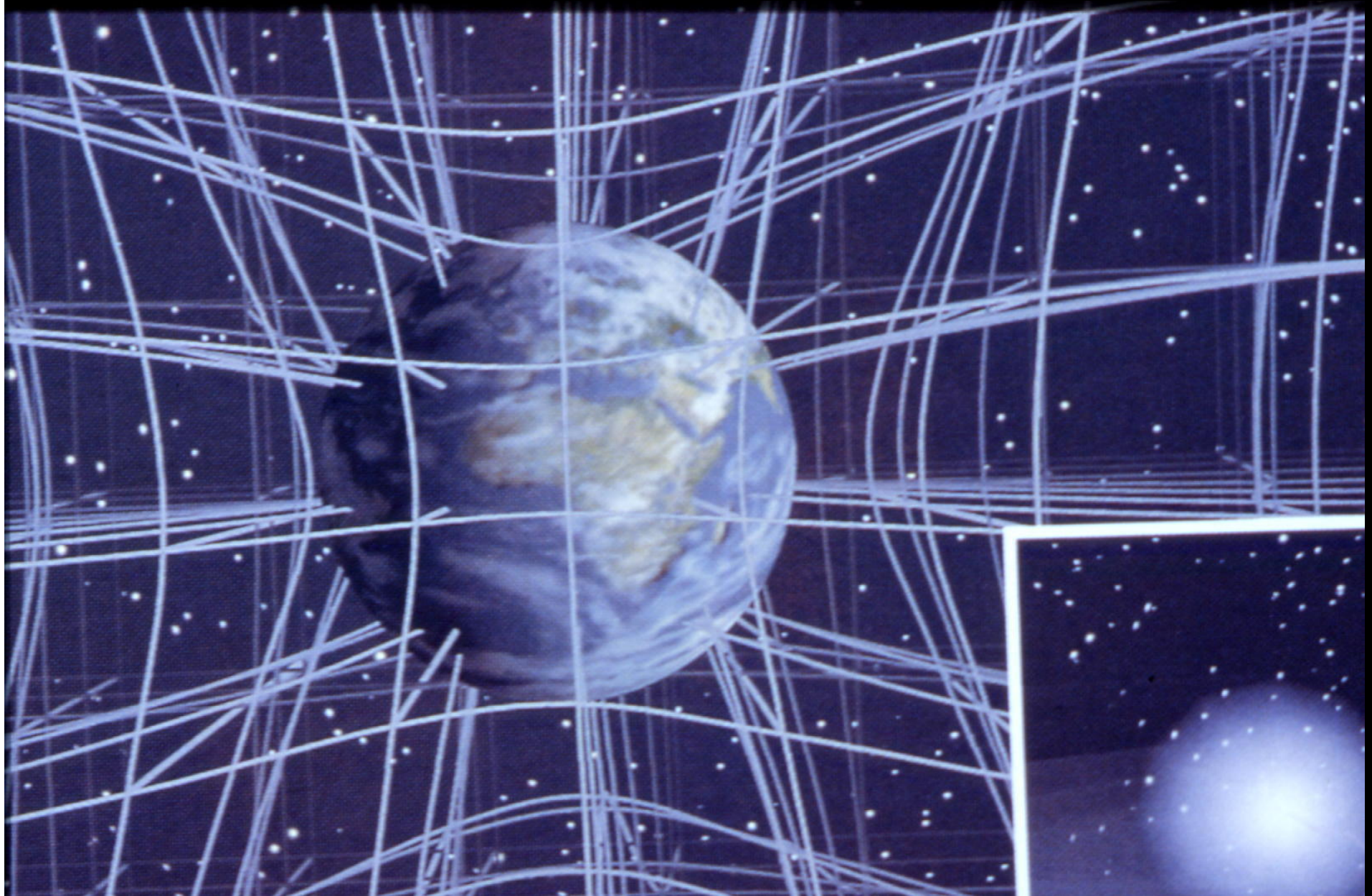


Velocità warp



Il modo migliore per cercare d'ipotizzare
i nostri futuri viaggi nello spazio,





EQUAZIONI DI EINSTEIN

(Relatività generale)

$$G_{ab} = 8\pi T_{ab}$$

$$G_{ab} = R_{ab} - 1/2 g_{ab} R$$

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(Relatività generale)

$$G_{ab} = 8\pi T_{ab}$$

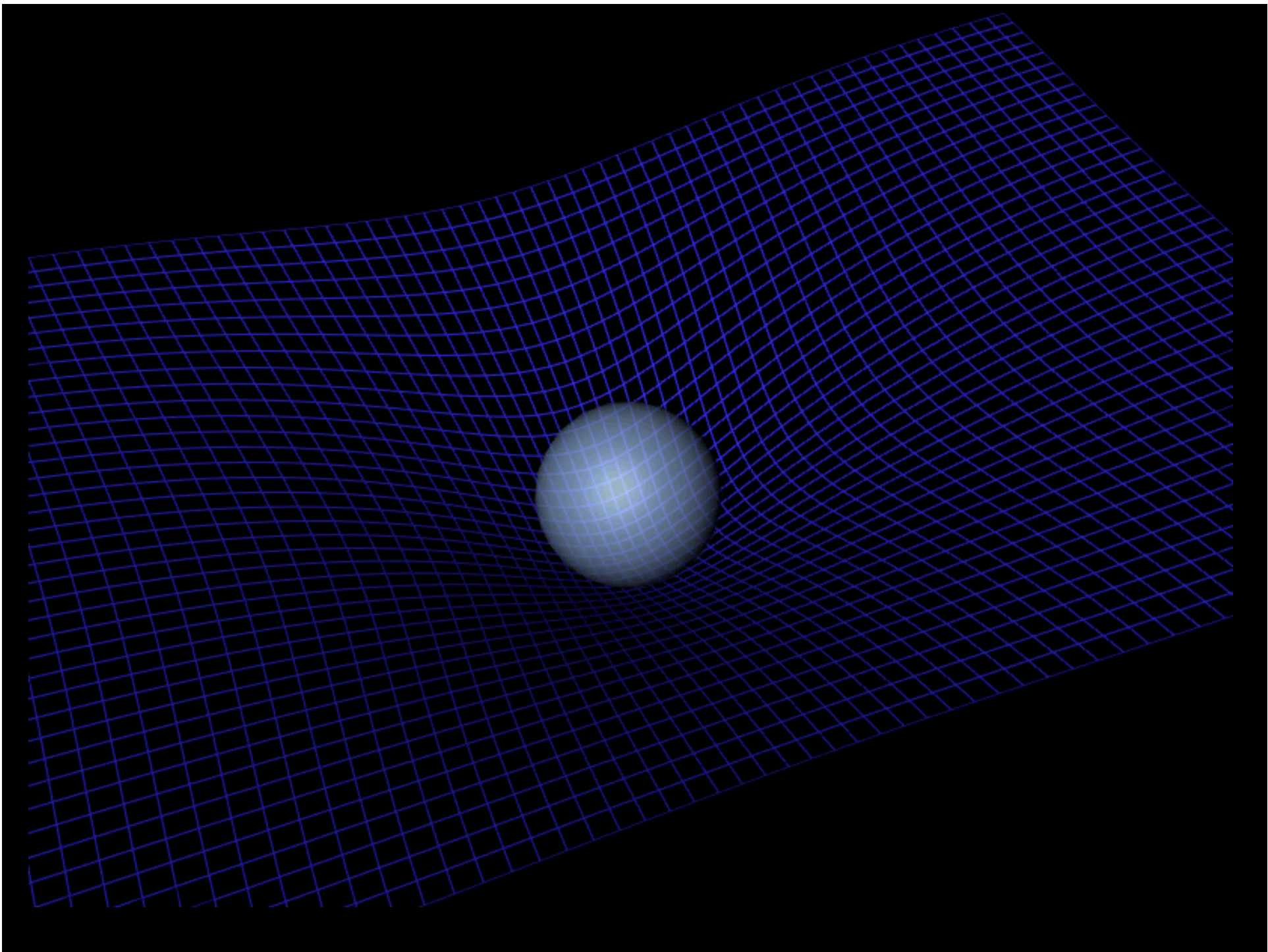
$$G_{ab} = R_{ab} - 1/2 g_{ab} R + \Lambda g_{ab}$$

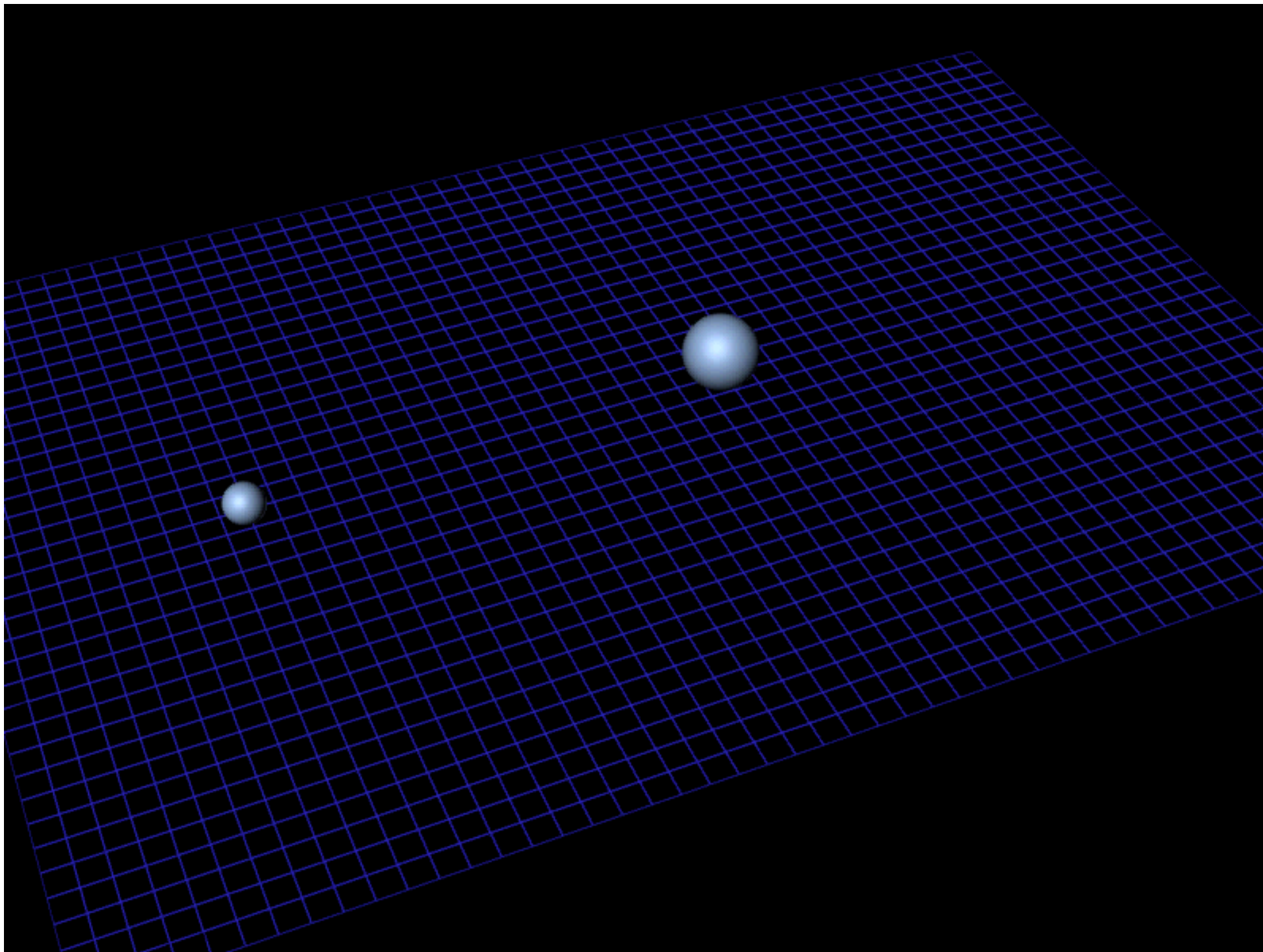
EQUAZIONI DI EINSTEIN

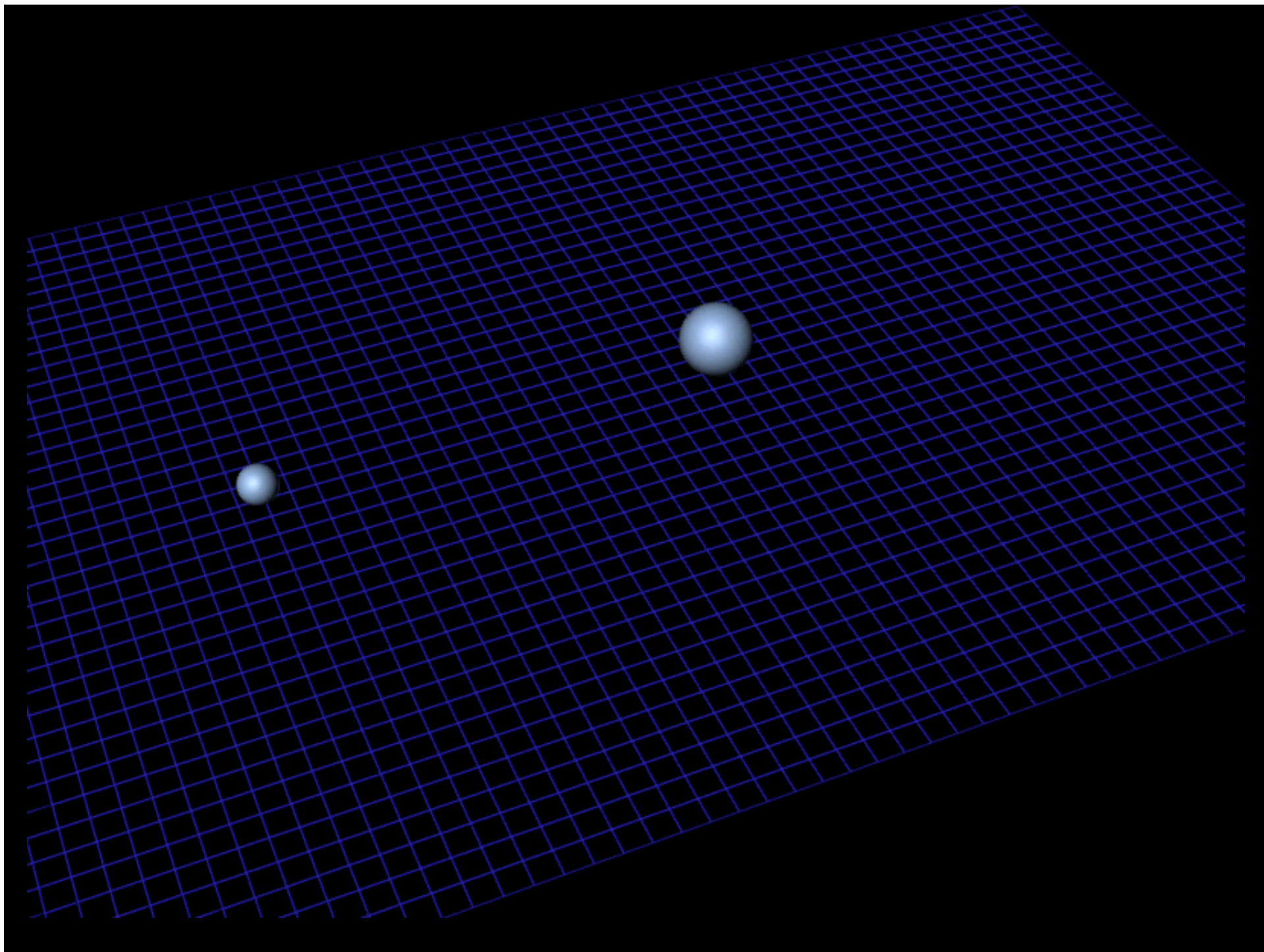
(Relatività generale)

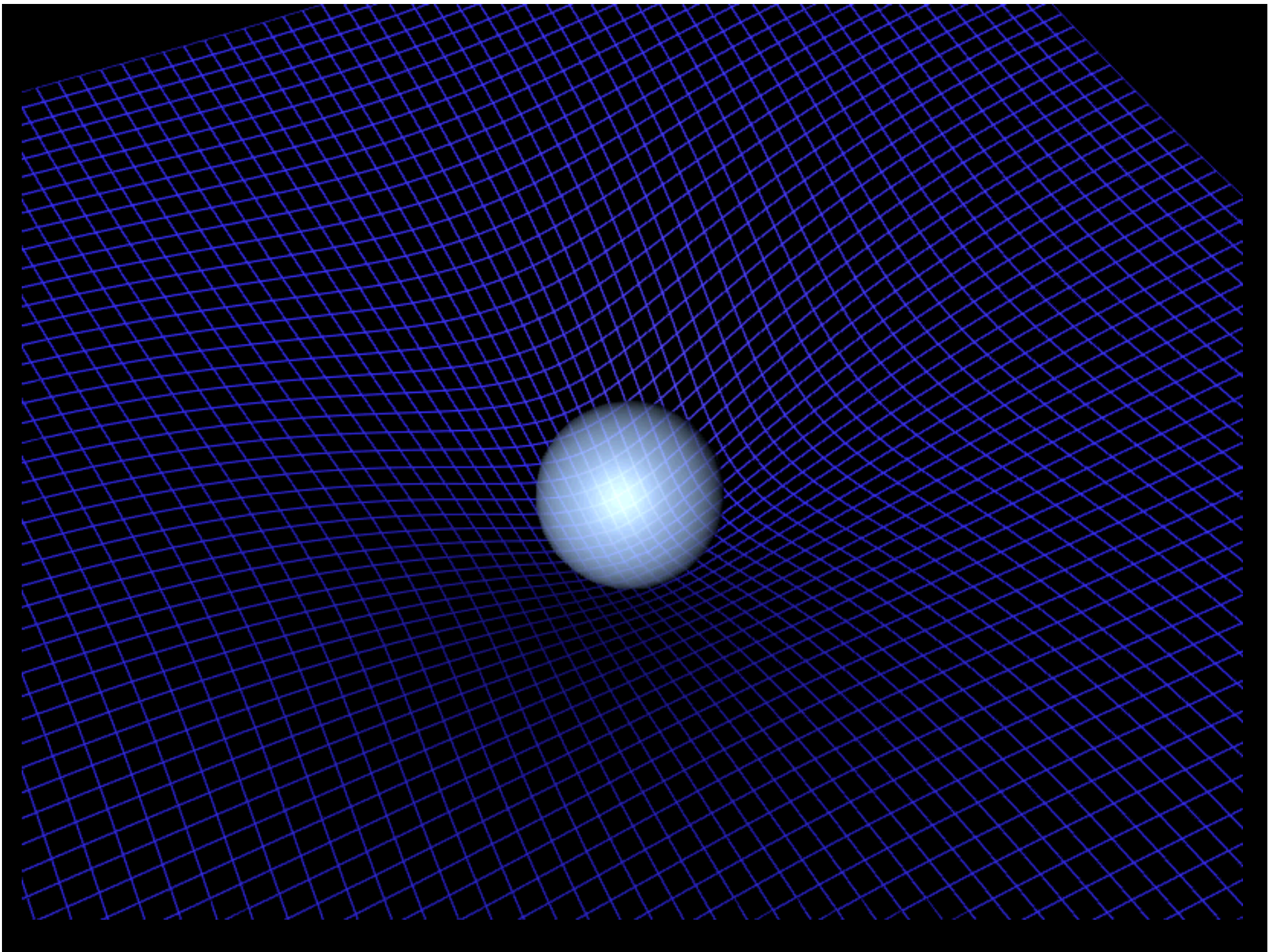
$$G_{ab} = 8\pi T_{ab}$$

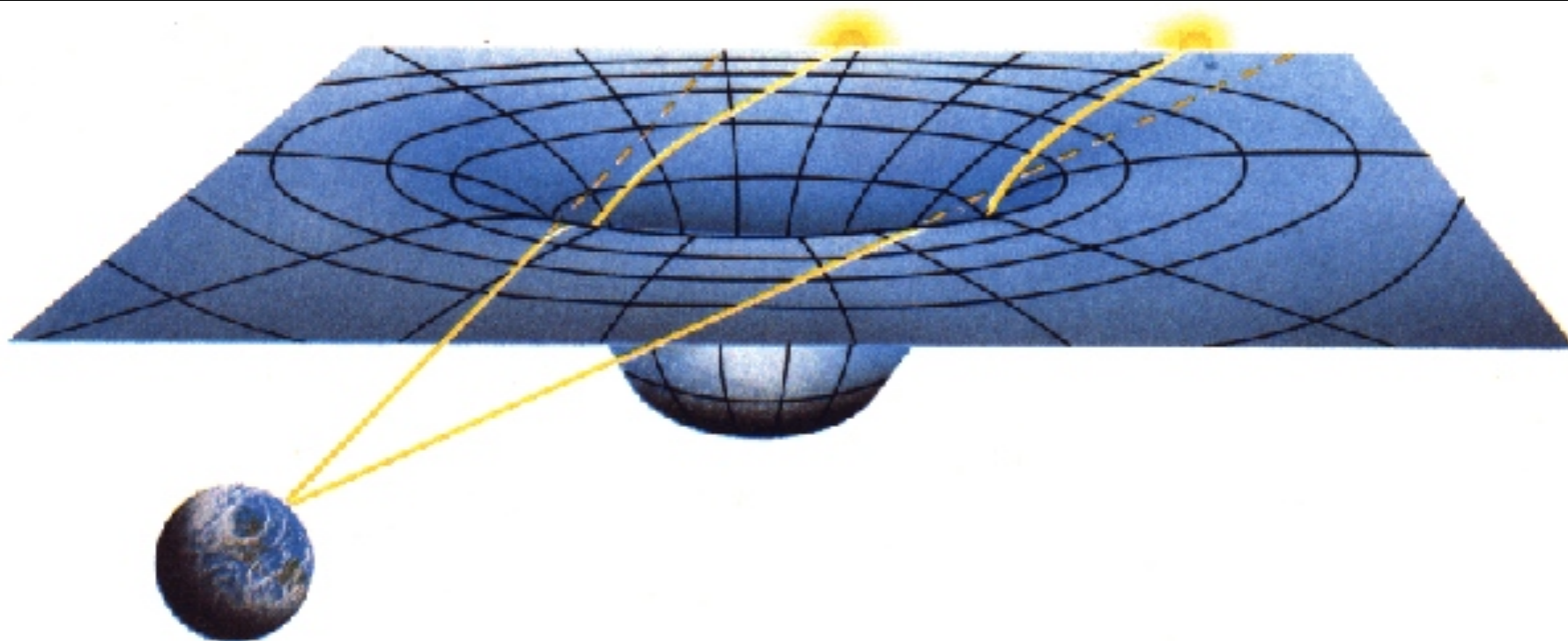
$$G_{ab} = R_{ab} - 1/2 g_{ab} R + \Lambda g_{ab}$$









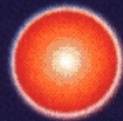


Posizione
vera
della
Stella A

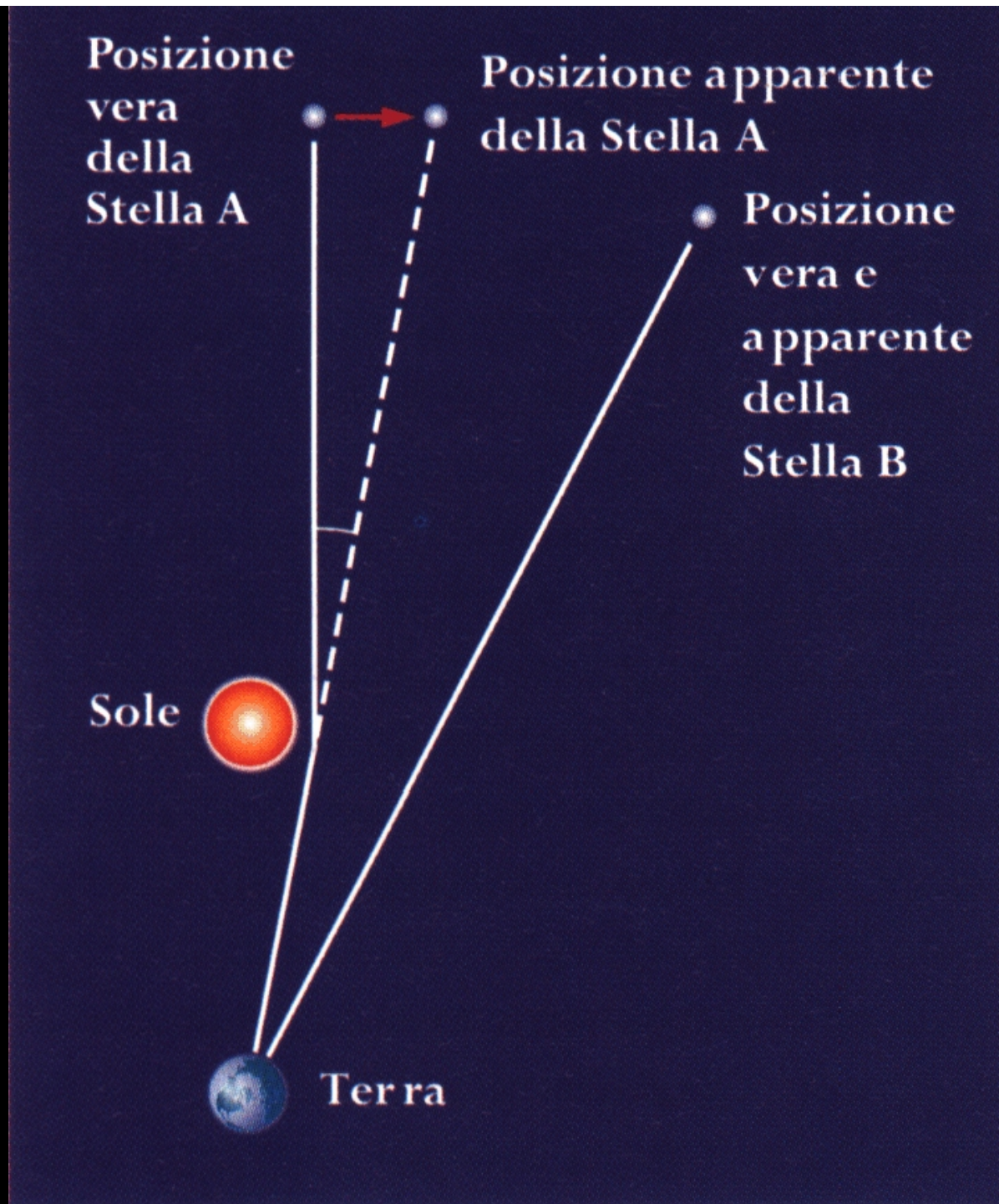
Posizione apparente
della Stella A

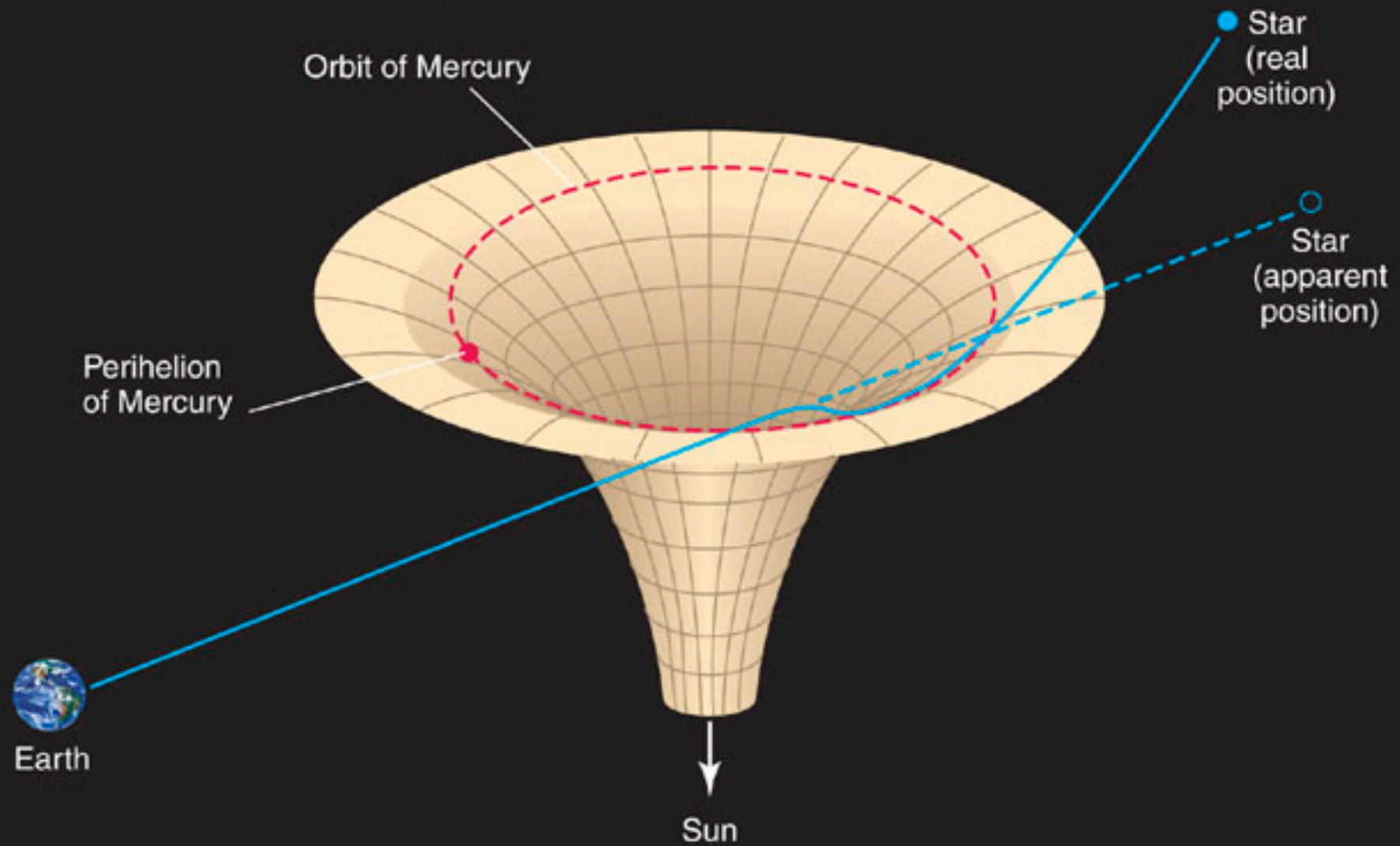
Posizione
vera e
apparente
della
Stella B

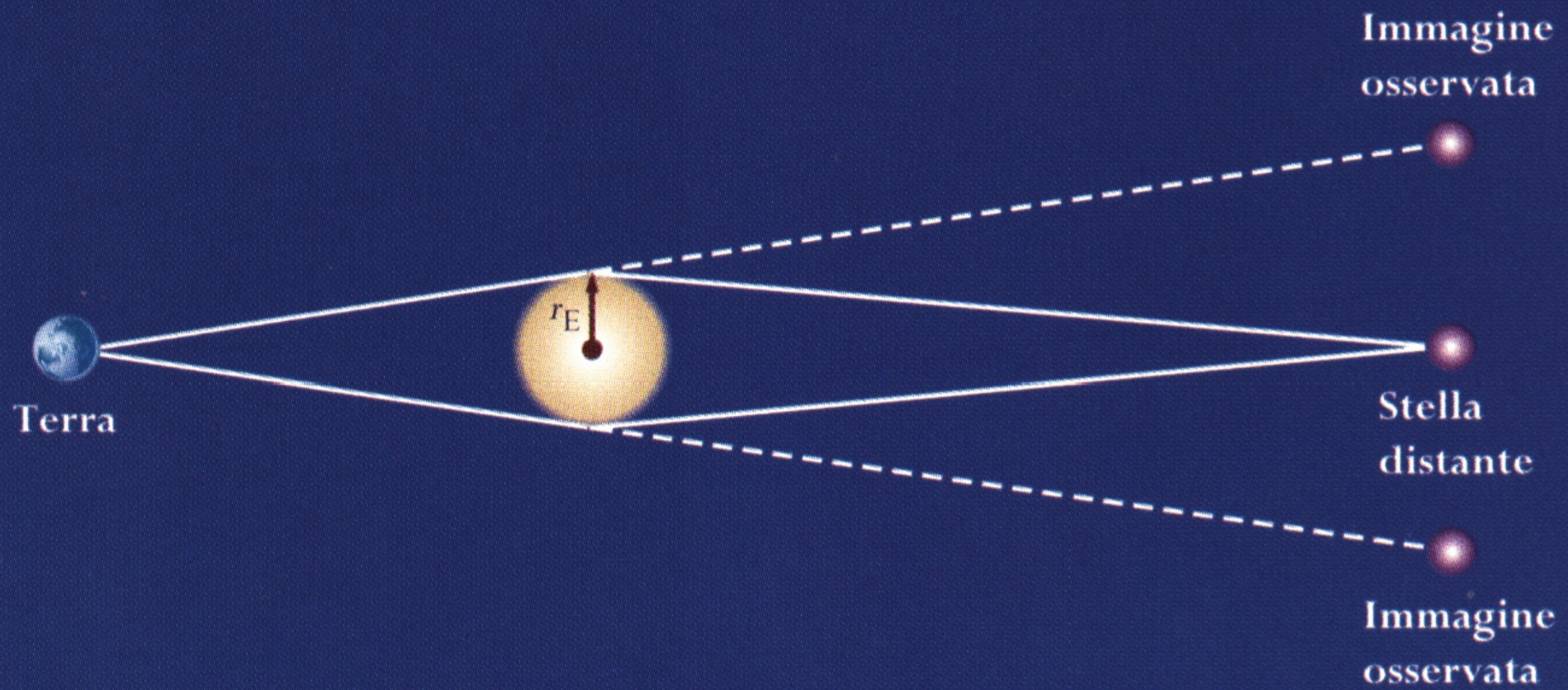
Sole

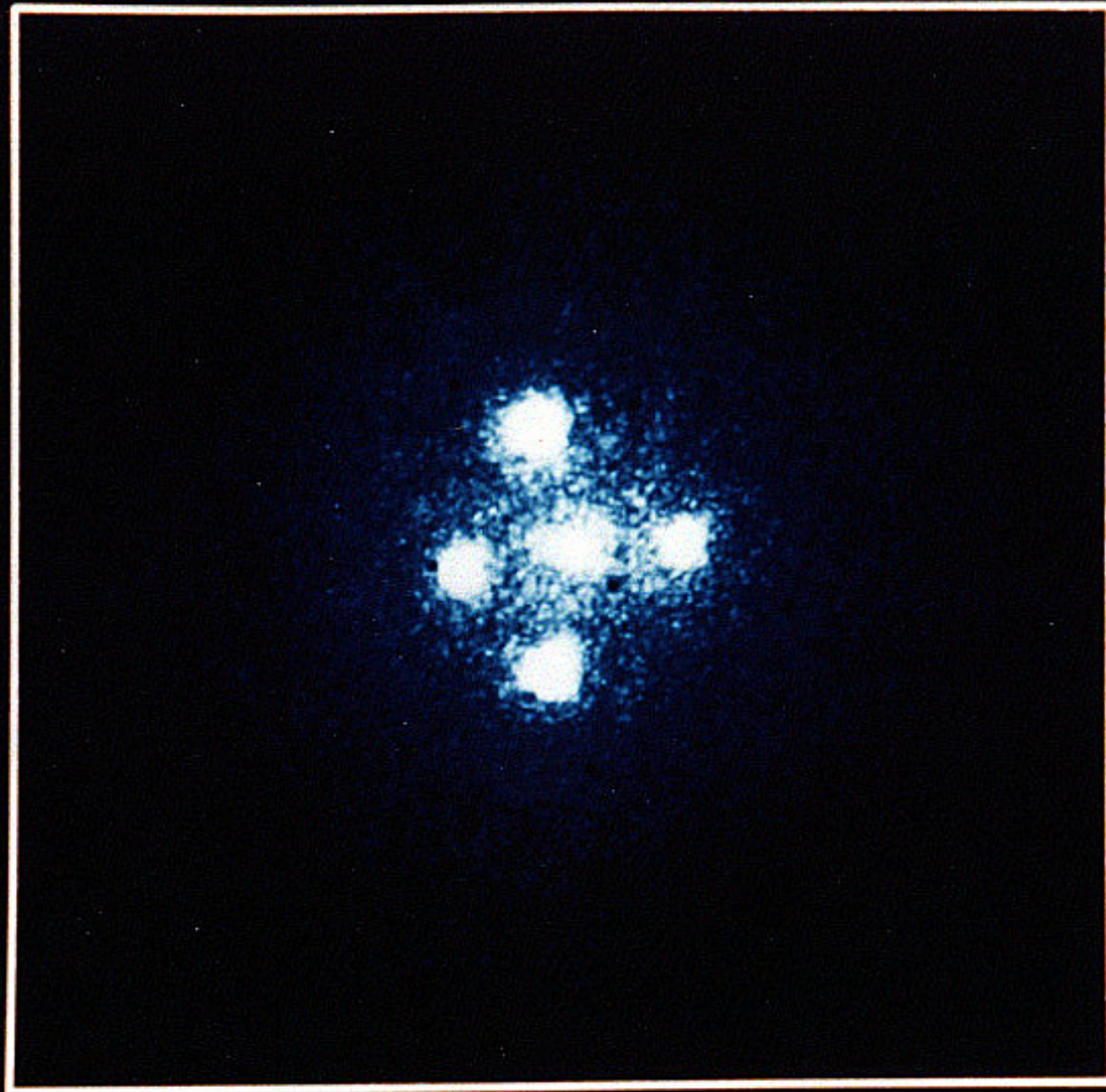


Terra

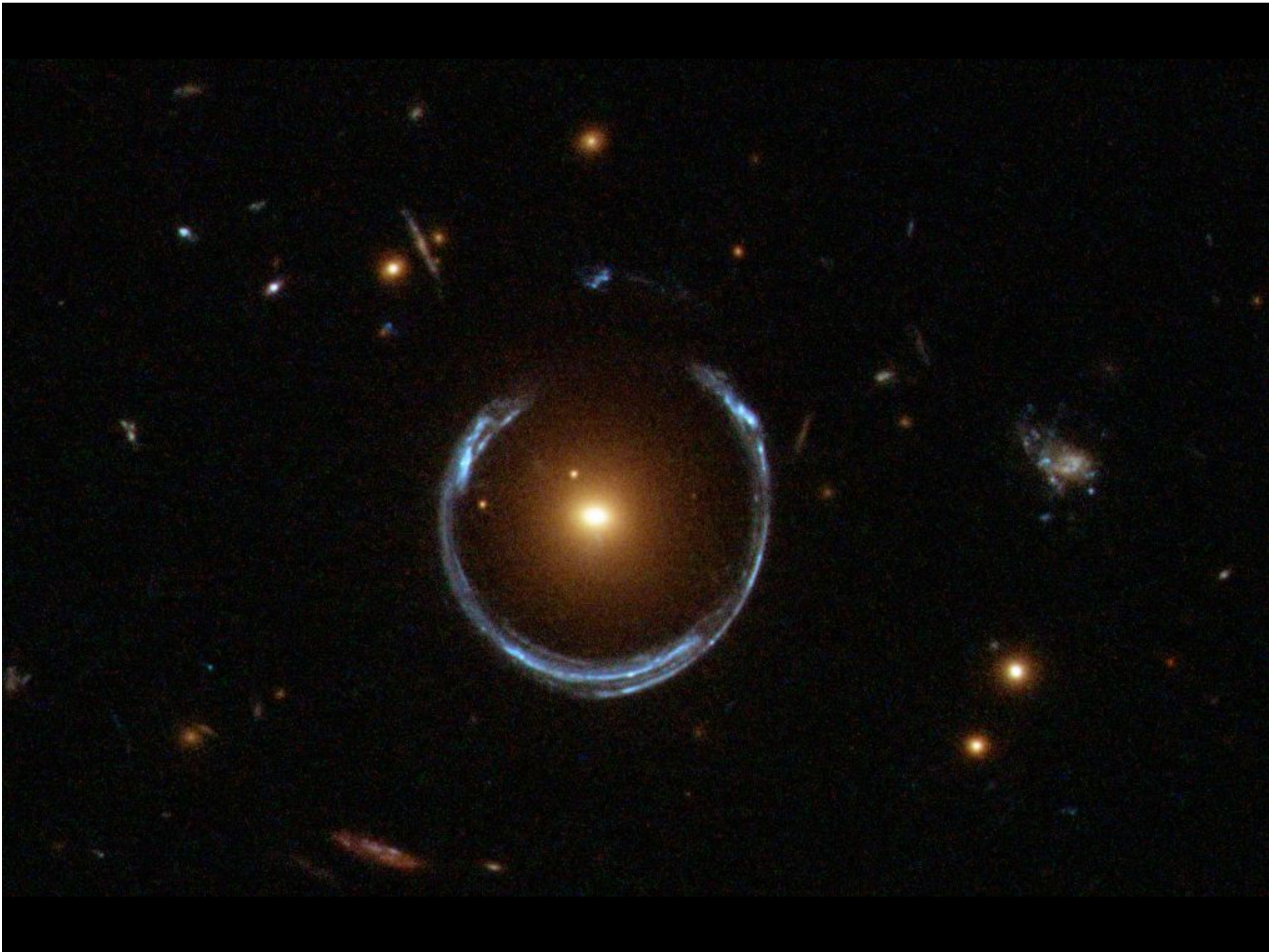








Gravitational Lens G2237+0305



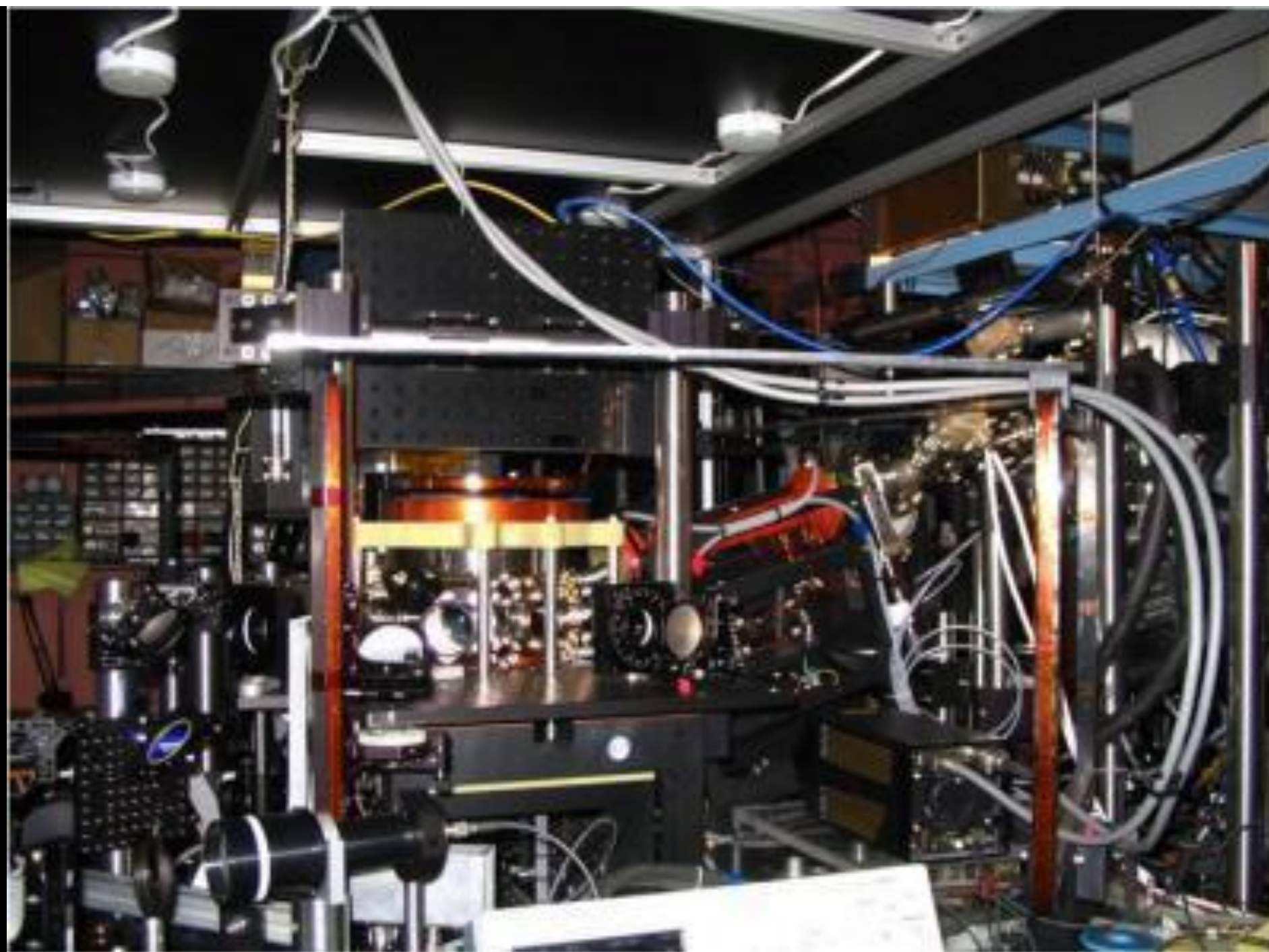


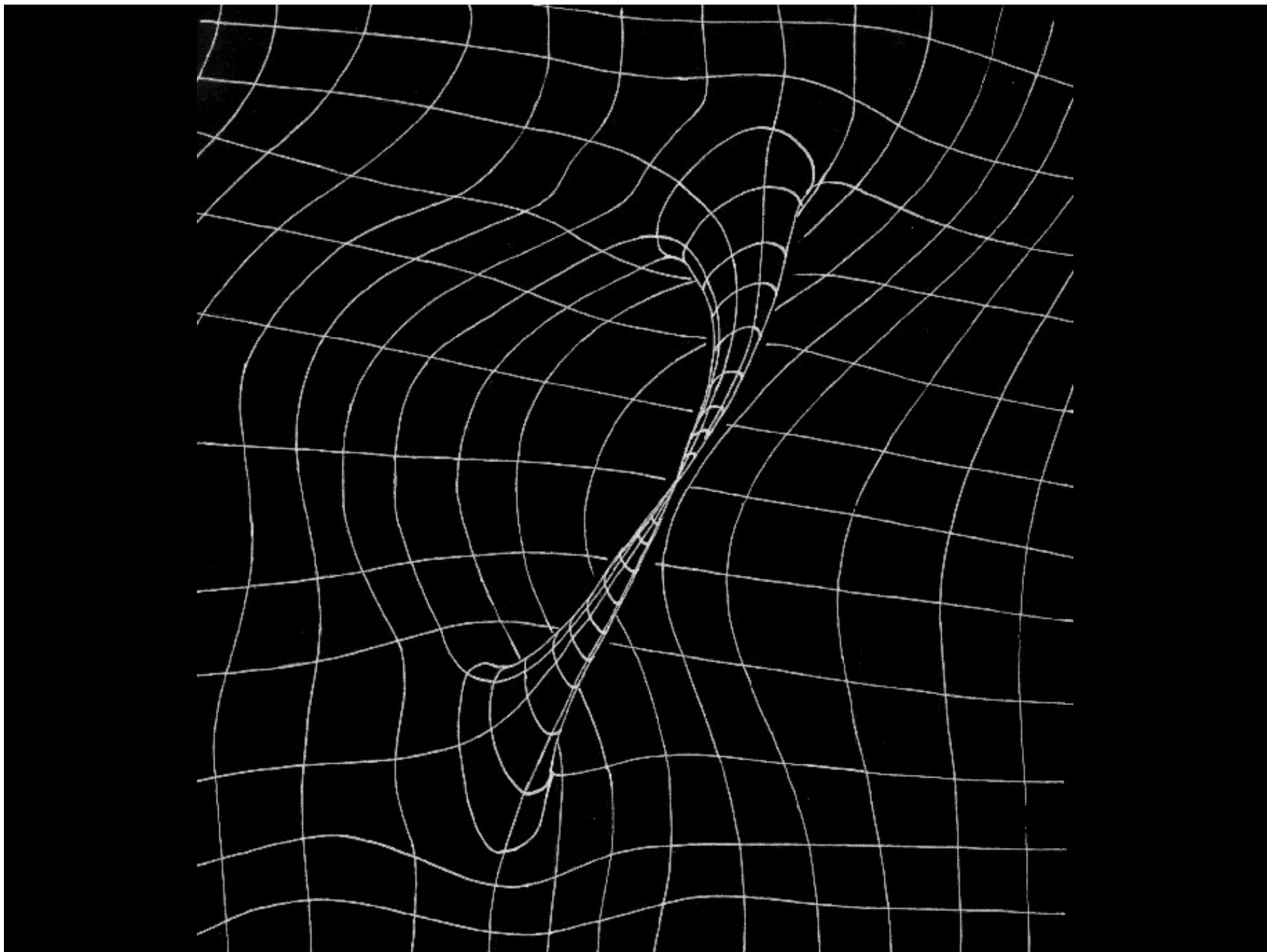
EQUAZIONI DI EINSTEIN

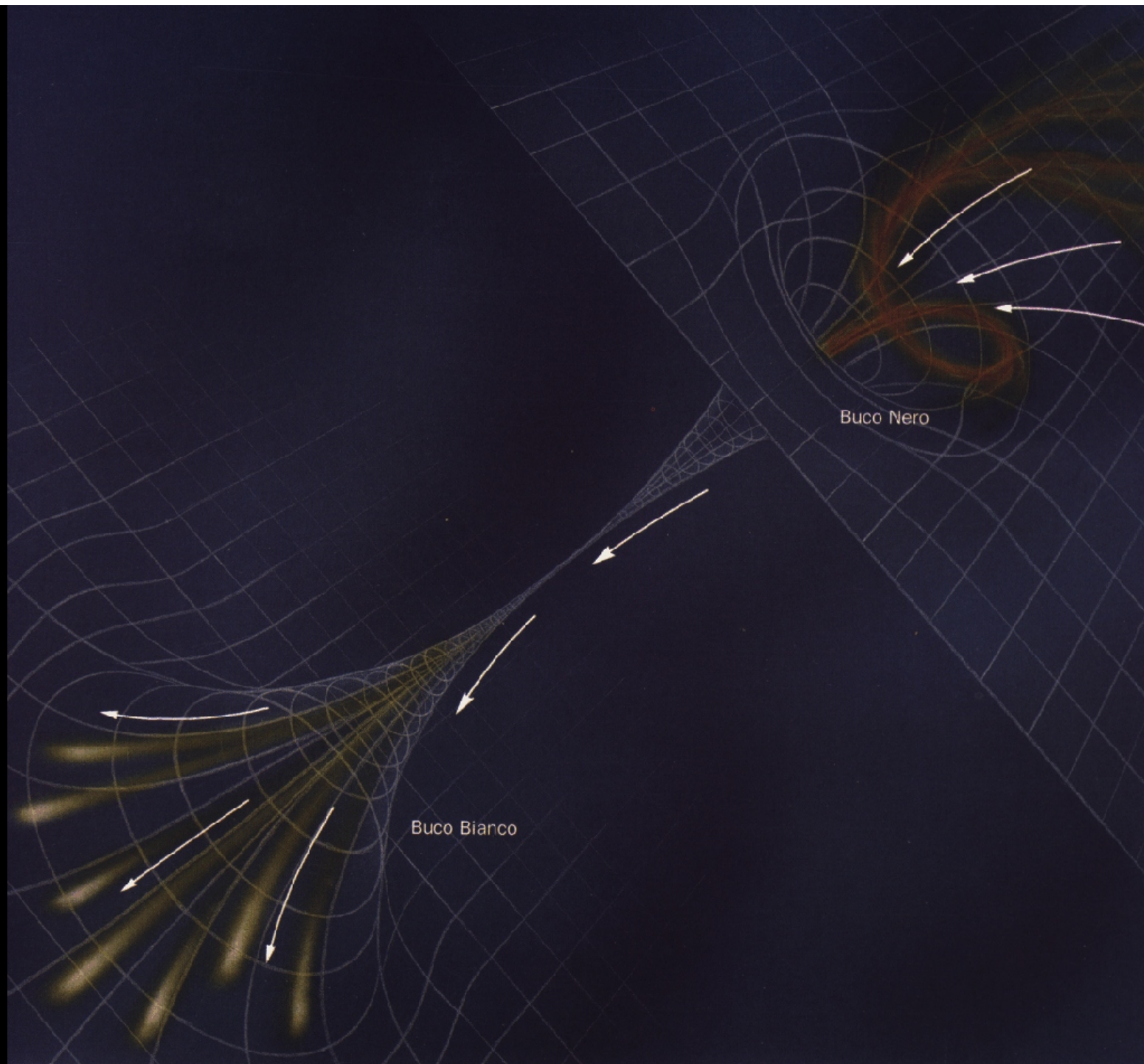
(Relatività generale)

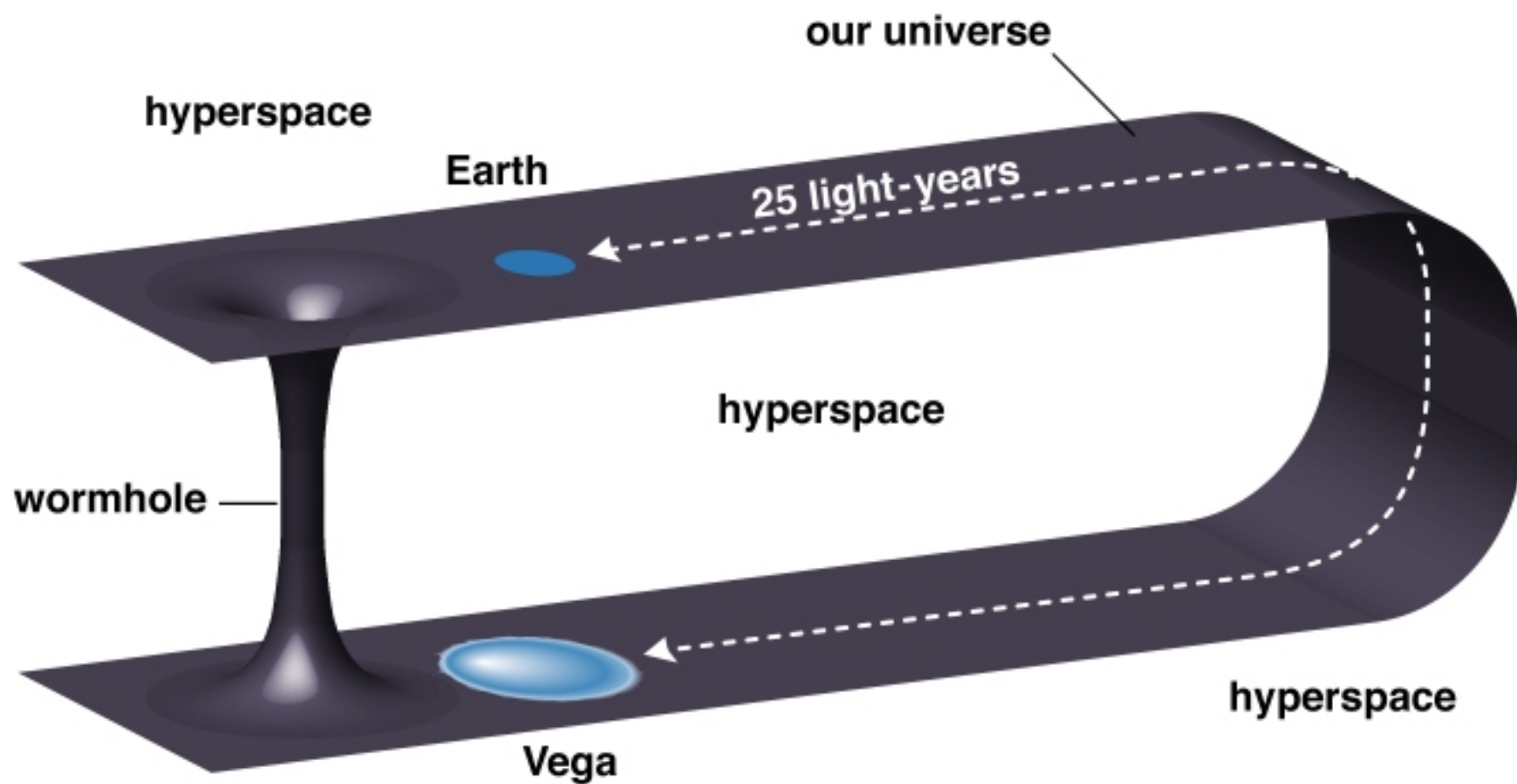
$$G_{ab} = 8\pi T_{ab}$$

$$G_{ab} = R_{ab} - 1/2 g_{ab} R$$

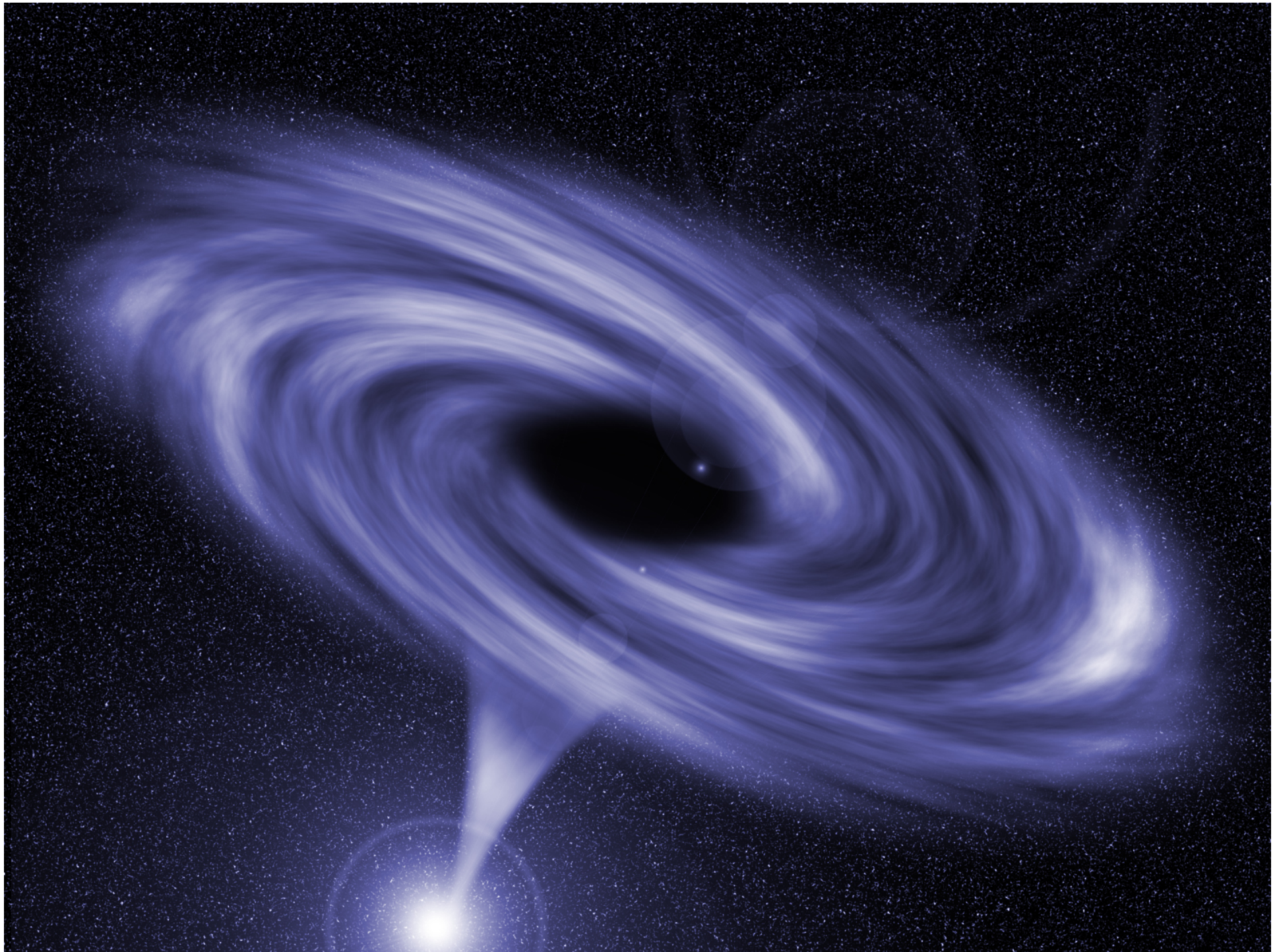


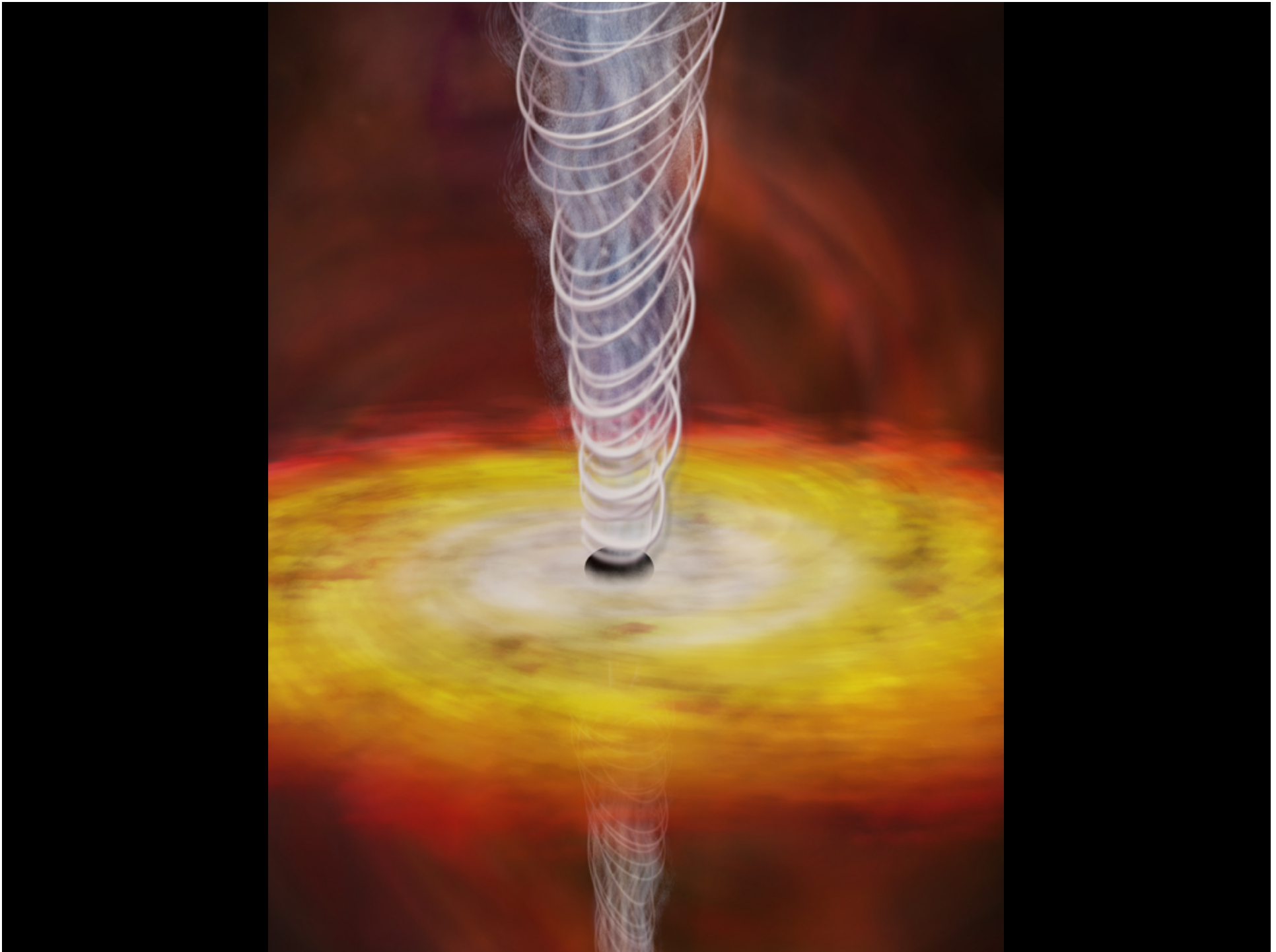


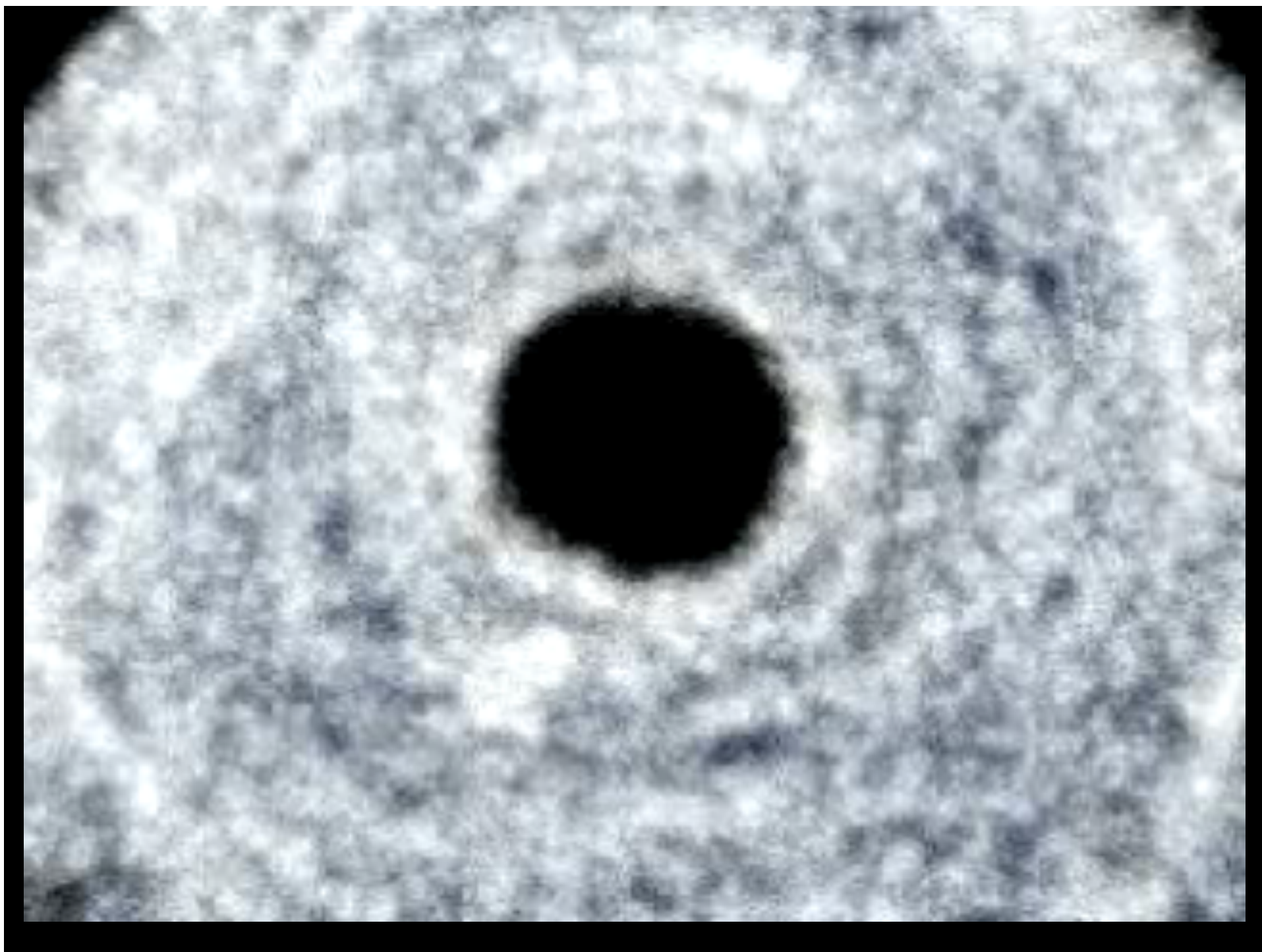




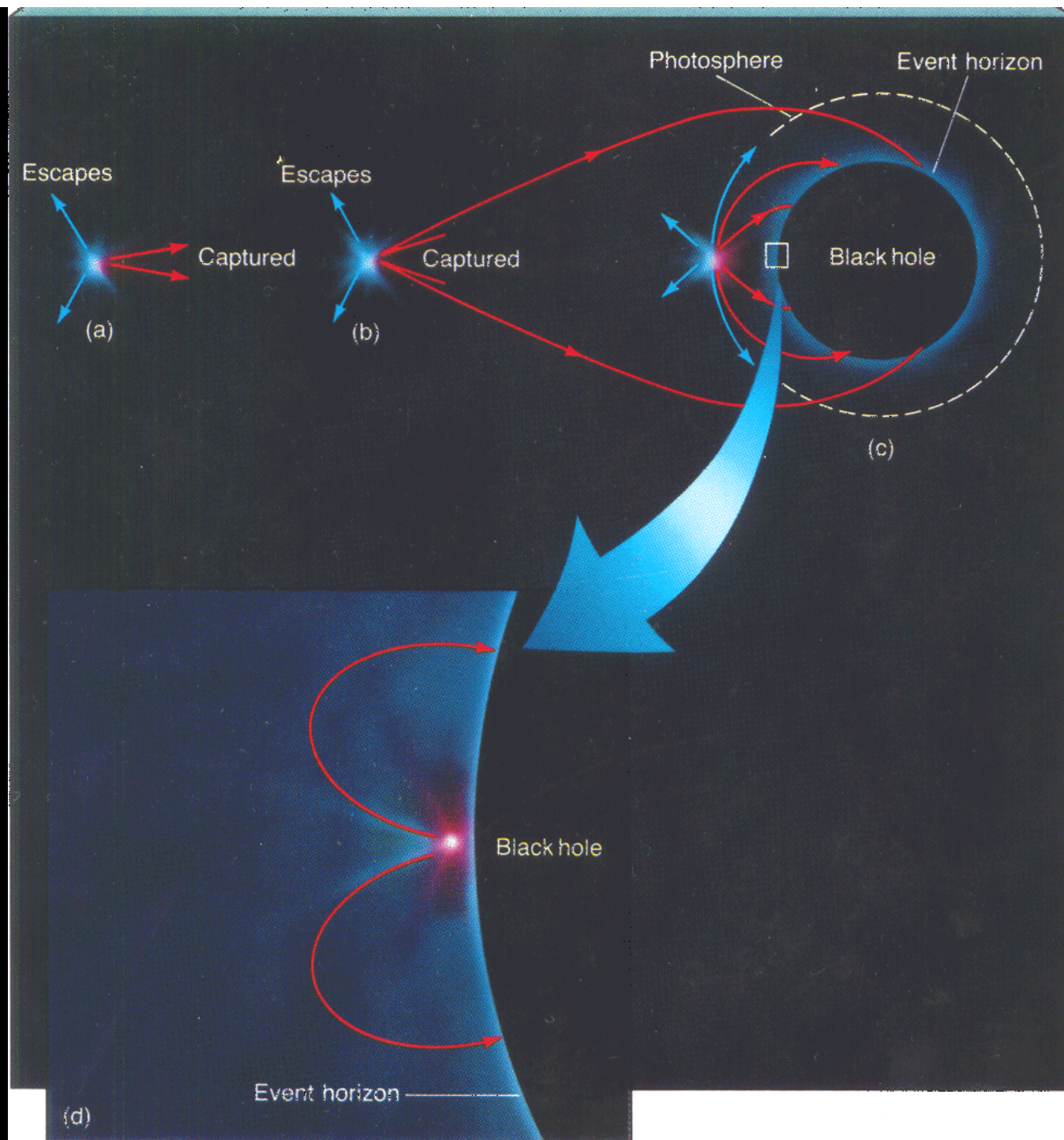
Viaggi tempo





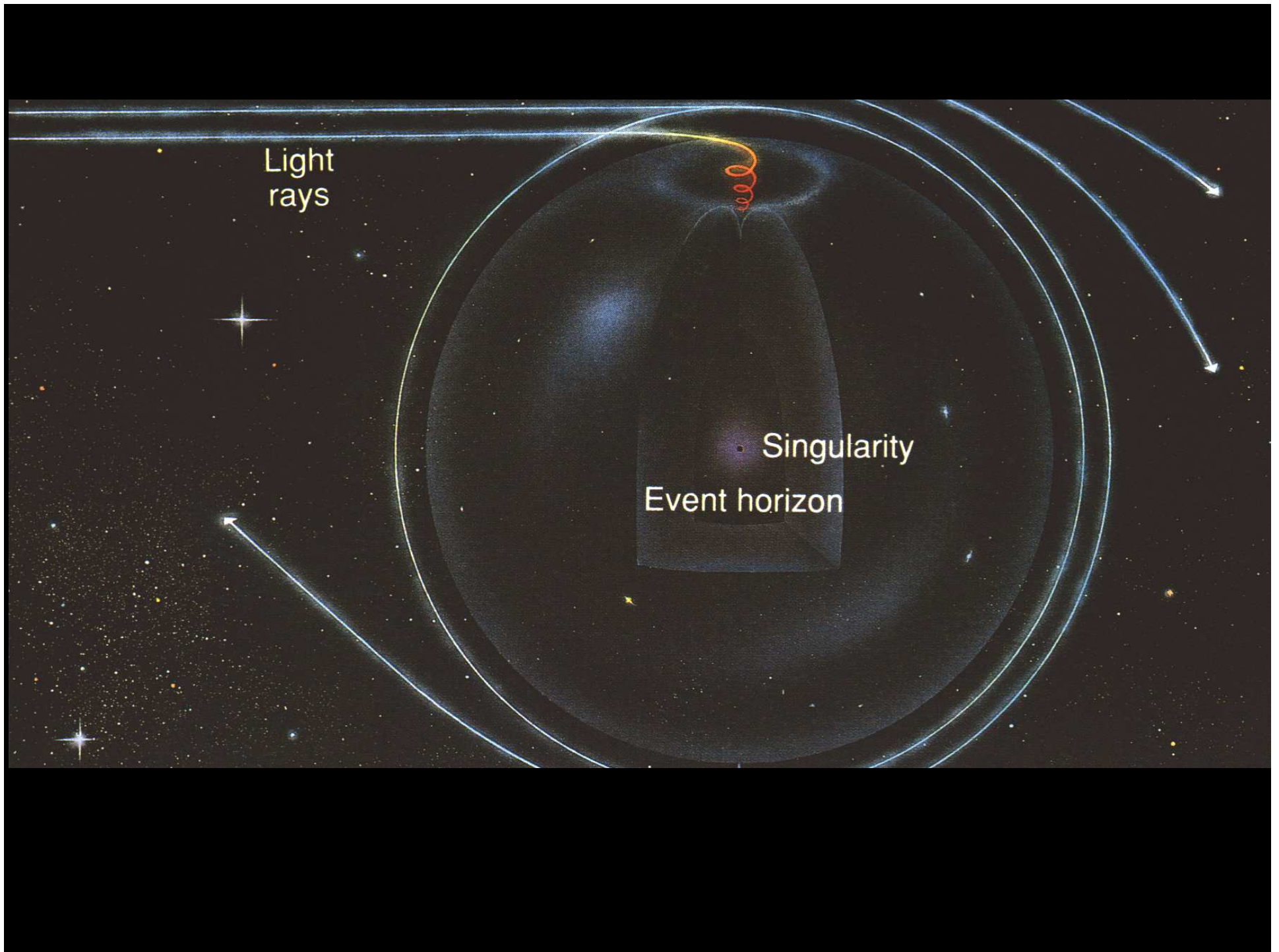


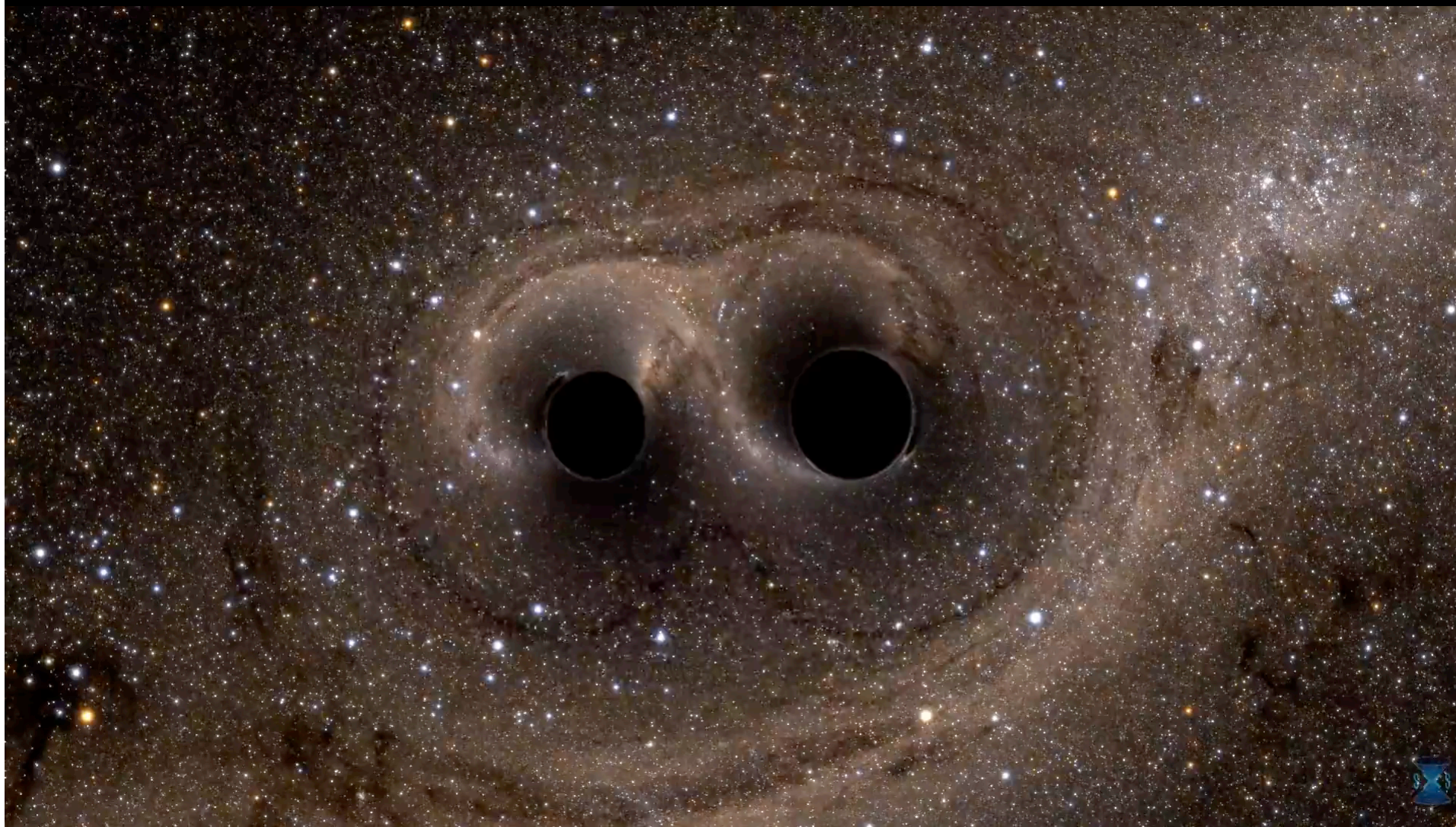


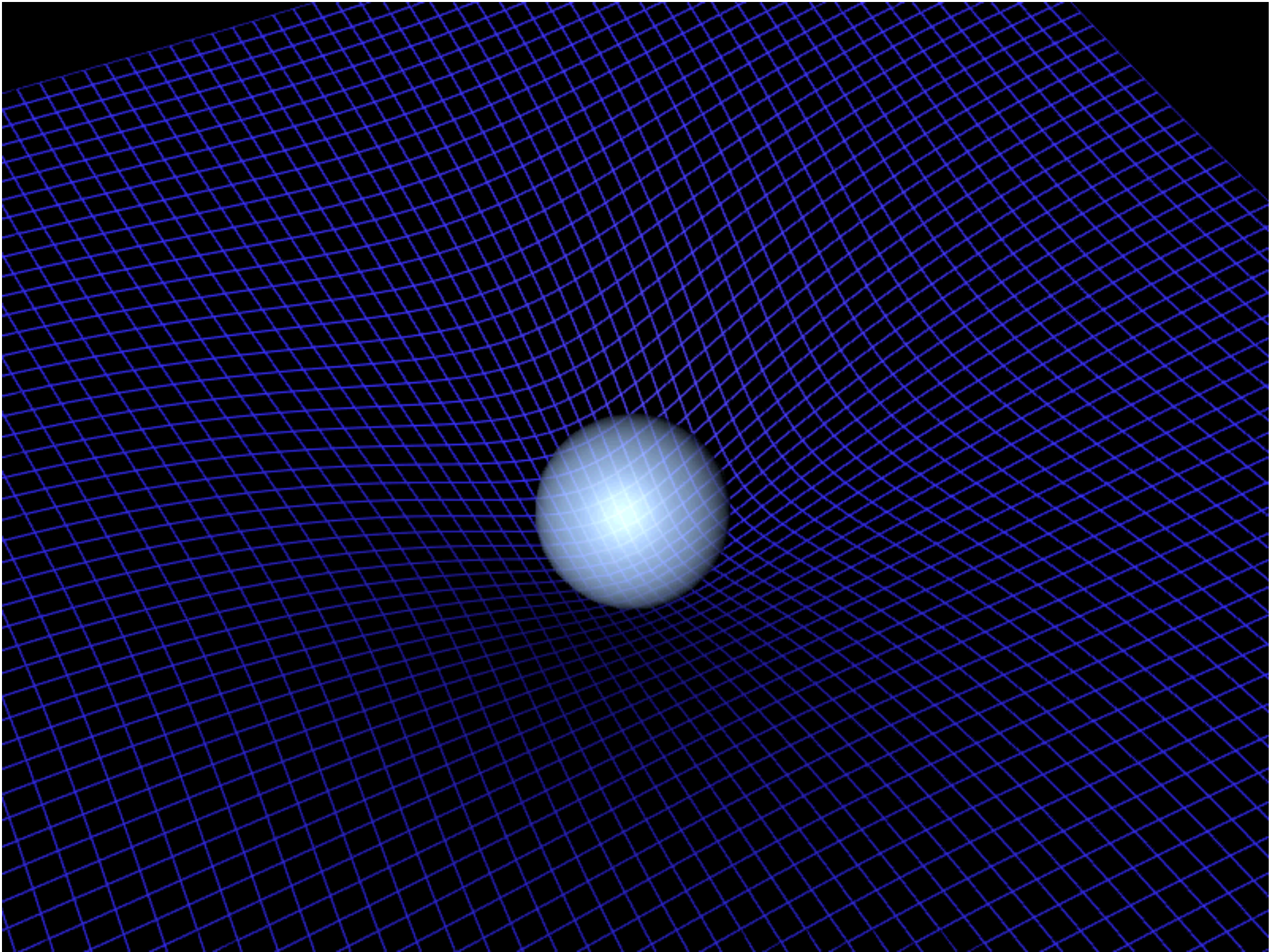


Light
rays

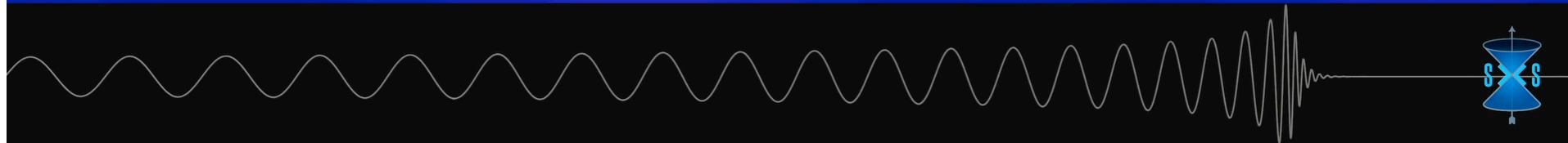
Singularity
Event horizon







-0.76s

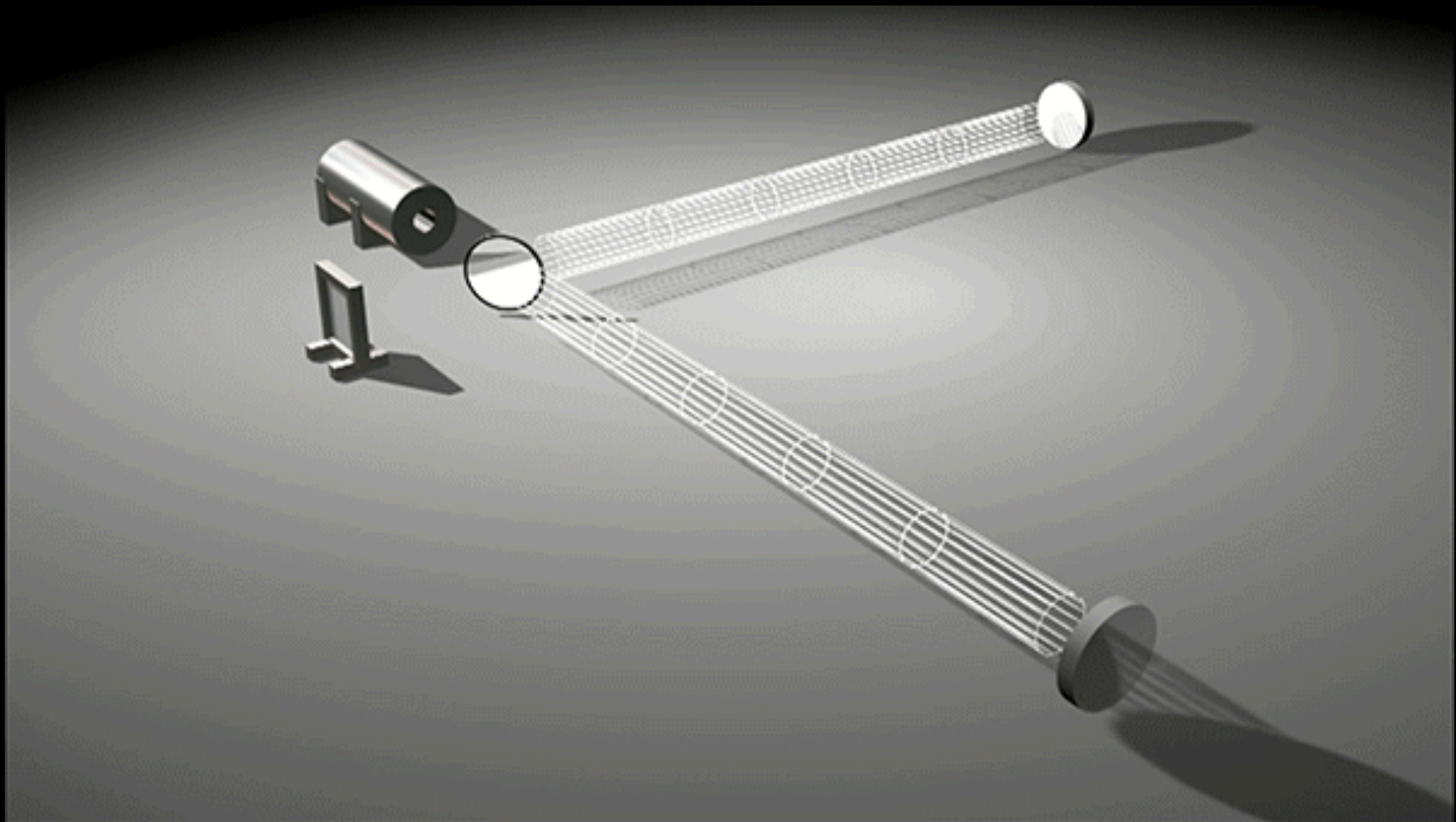




Scale of Effect Vastly Exaggerated



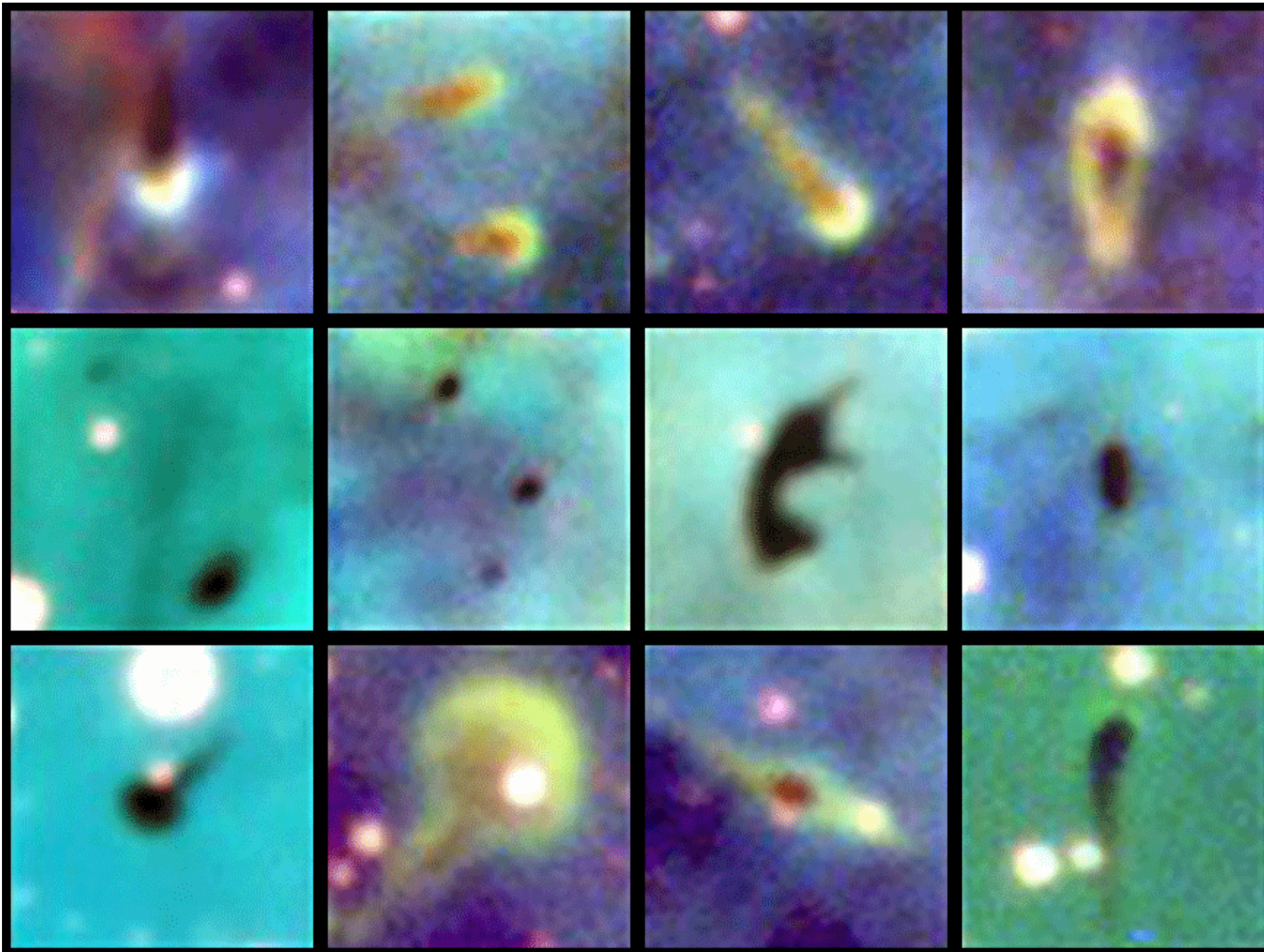
Principio di funzionamento dell'Interferometro

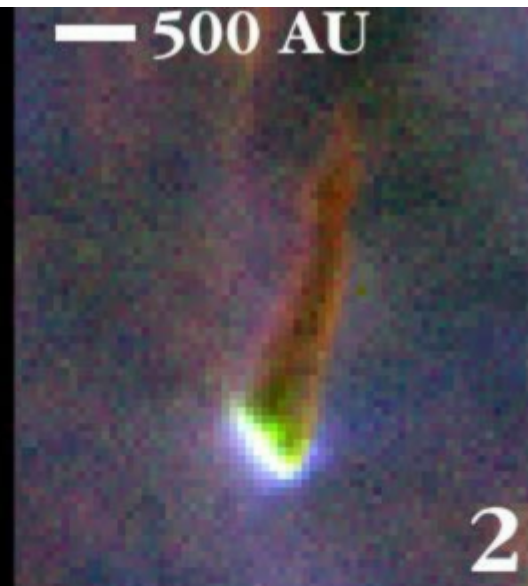
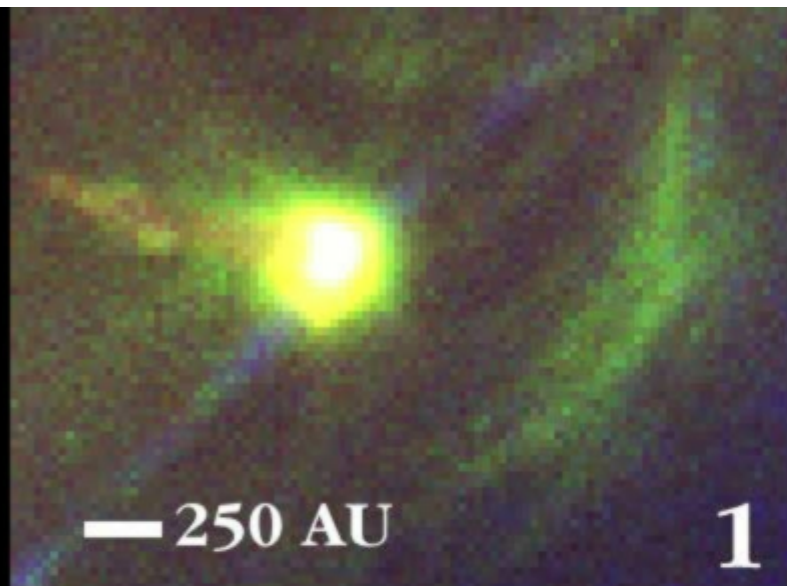






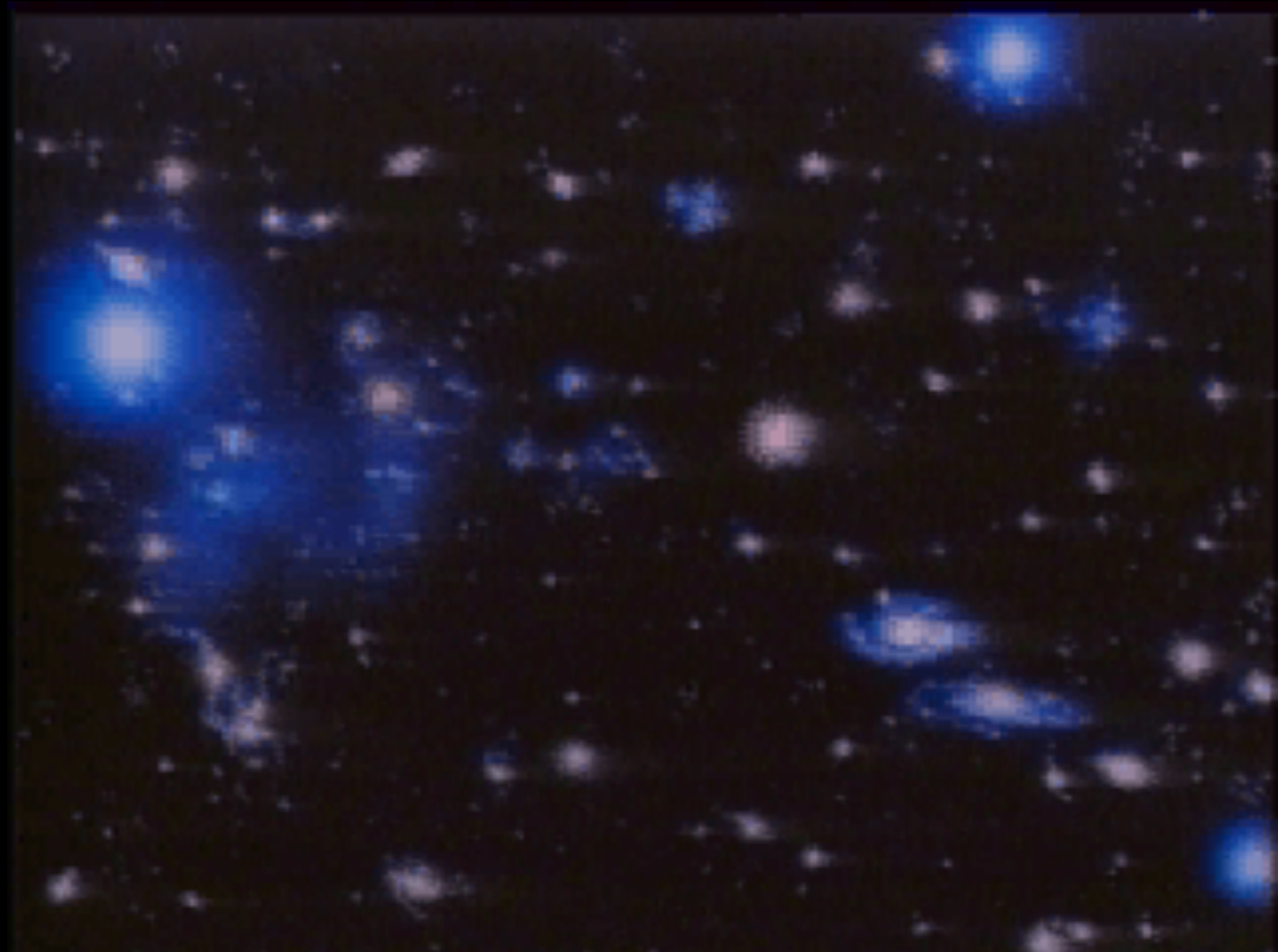


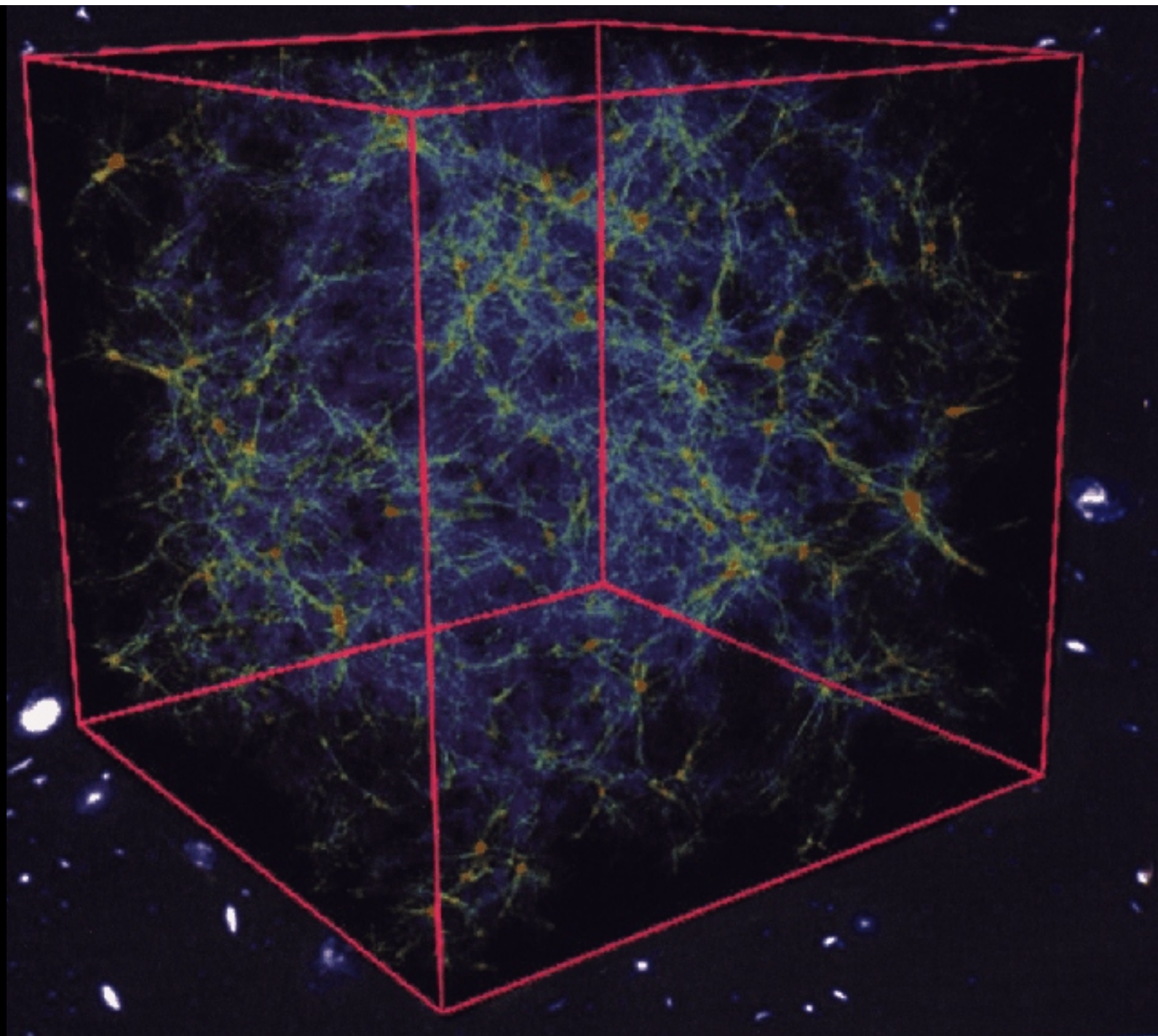




Orion nebula (Hayden Planetarium)







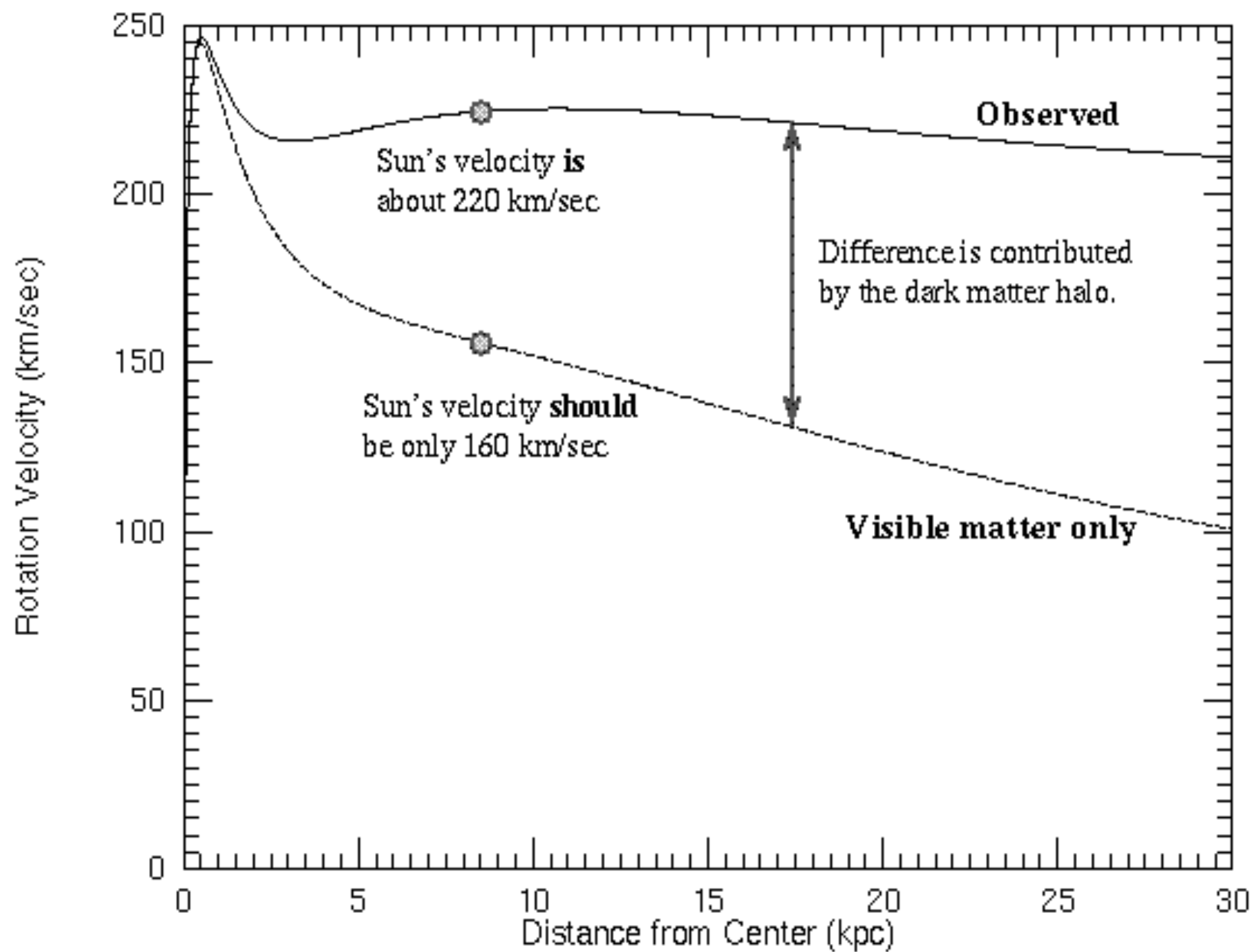
The known universe

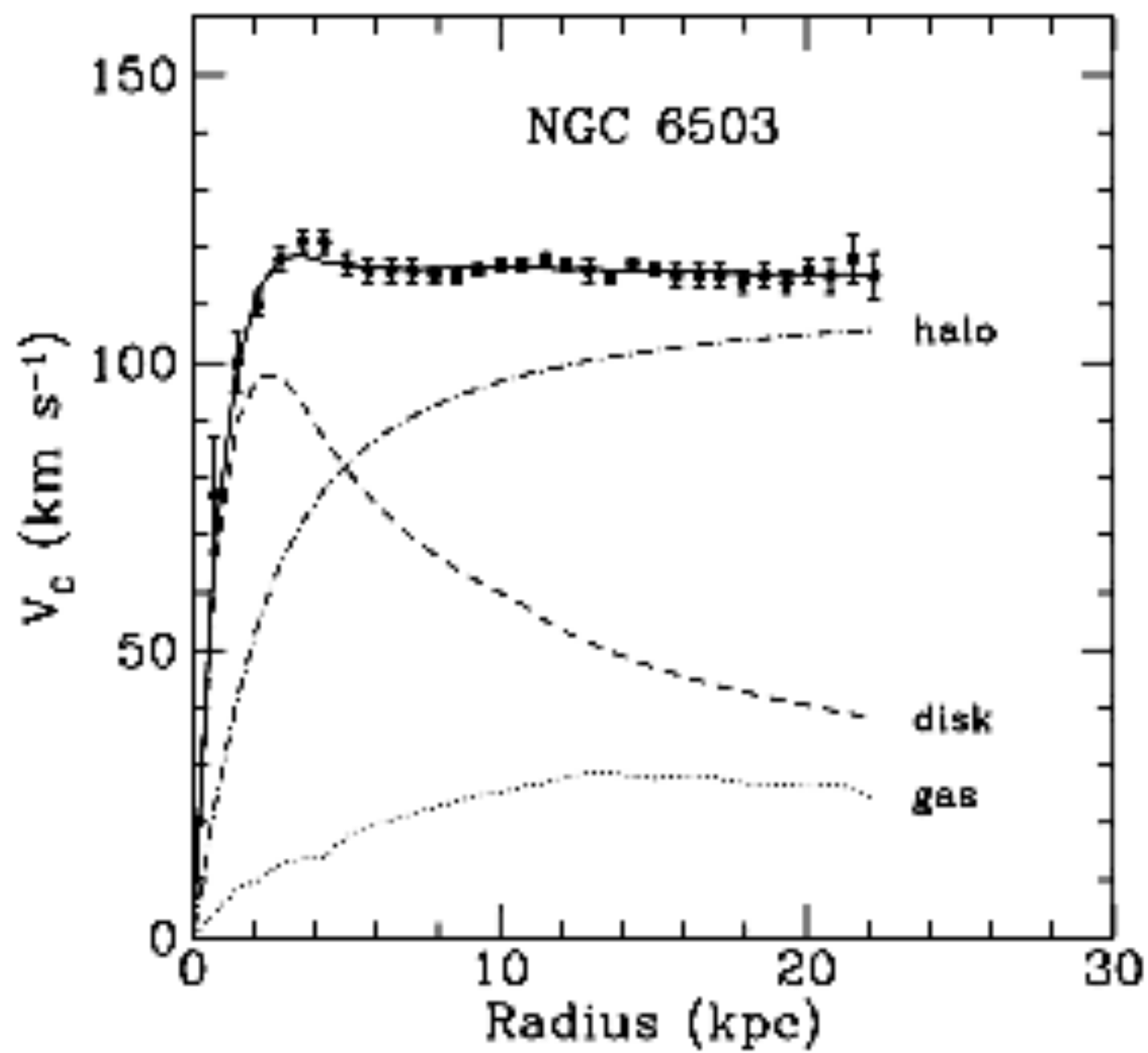
1. The observable universe is a sphere with a radius of about 46 billion light-years.

2. The universe is expanding, and the expansion is accelerating.

3. The universe is made of dark matter and dark energy.







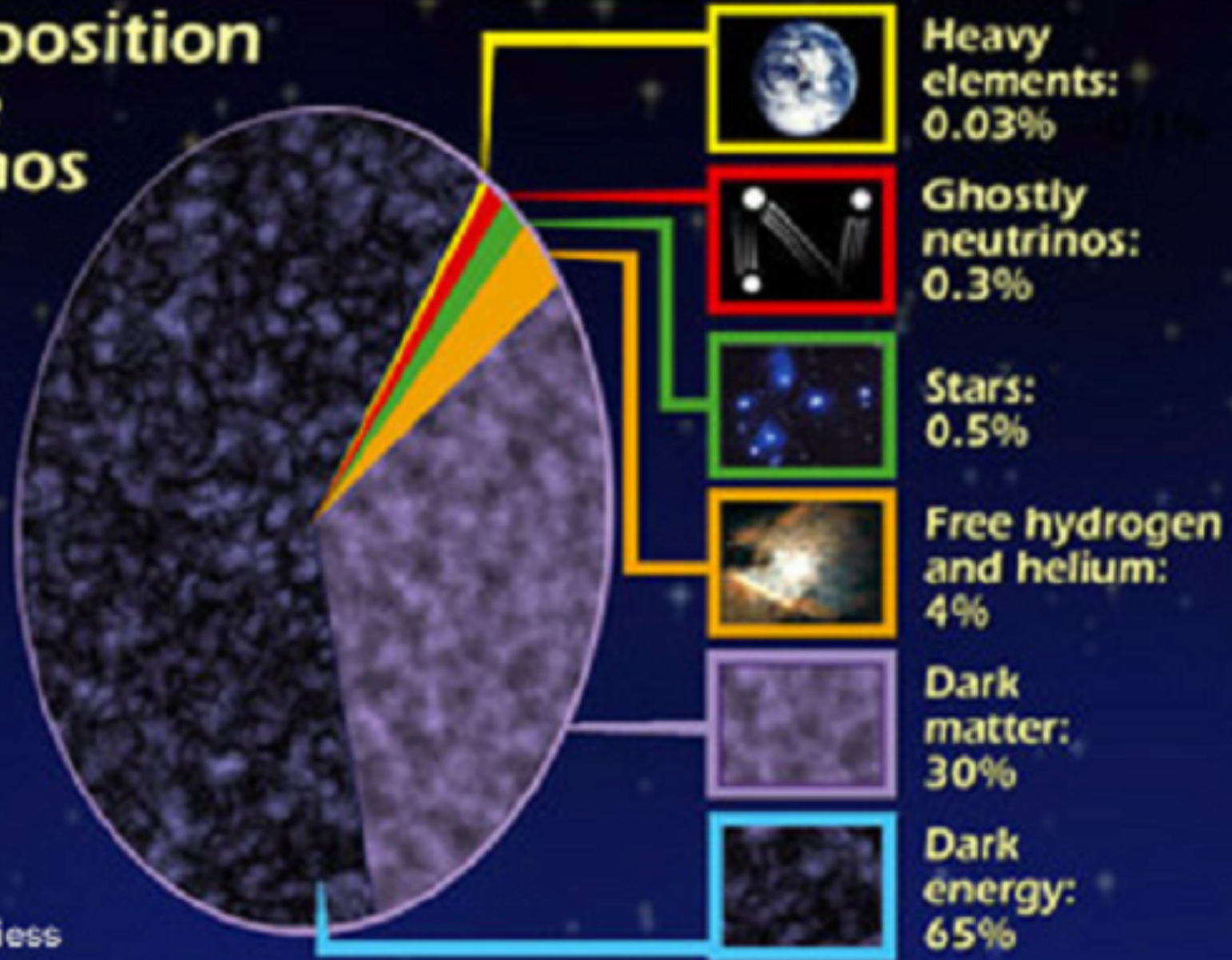


Galaxy Cluster Abell 2218

HST • WFPC2

NASA, A. Fruchter and the ERO Team (STScI, ST-ECF) • STScI-PRC00-08

Composition of the Cosmos

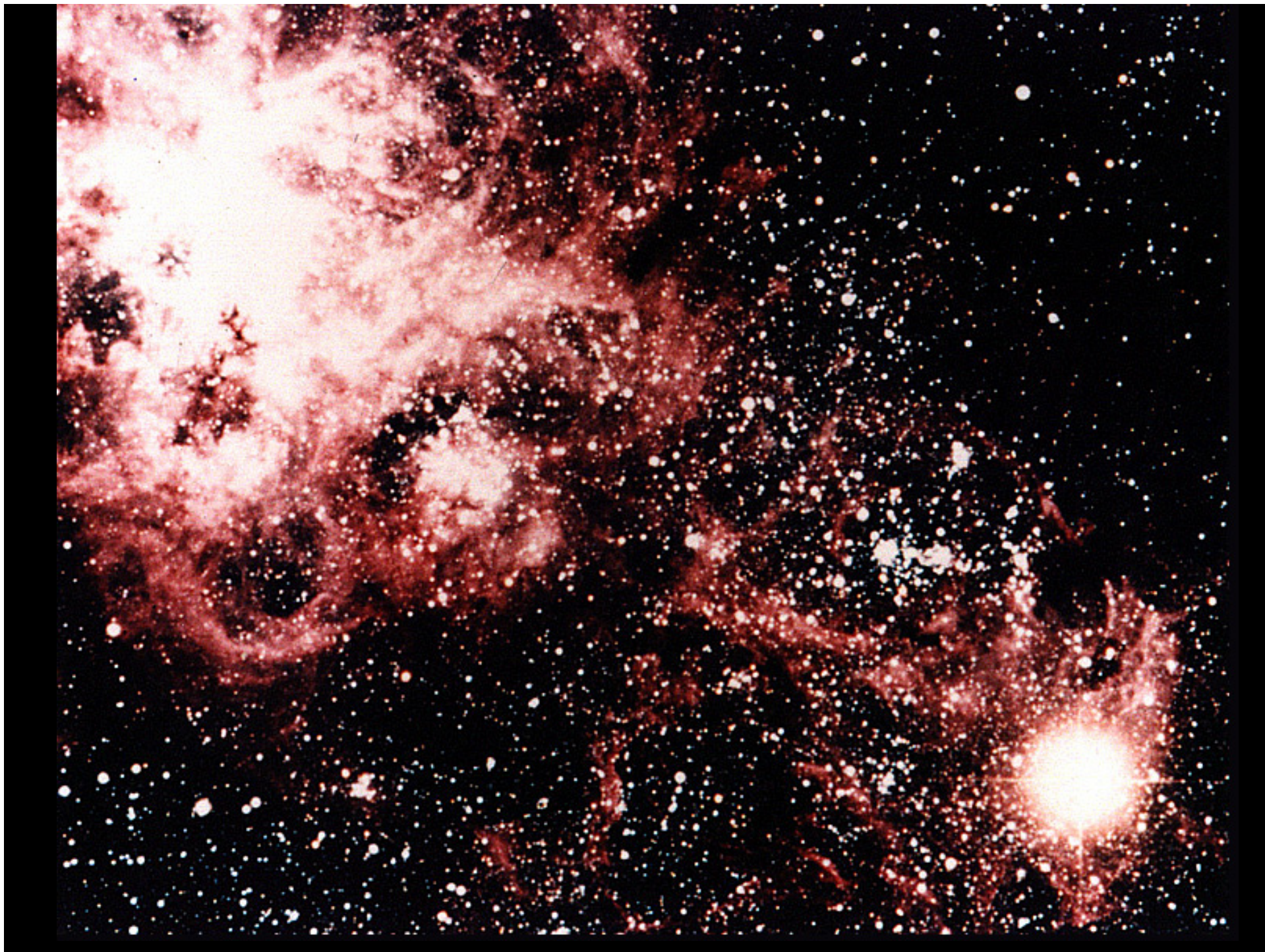


NASA/A. Riess



IL LATO OSCURO DELL'UNIVERSO...

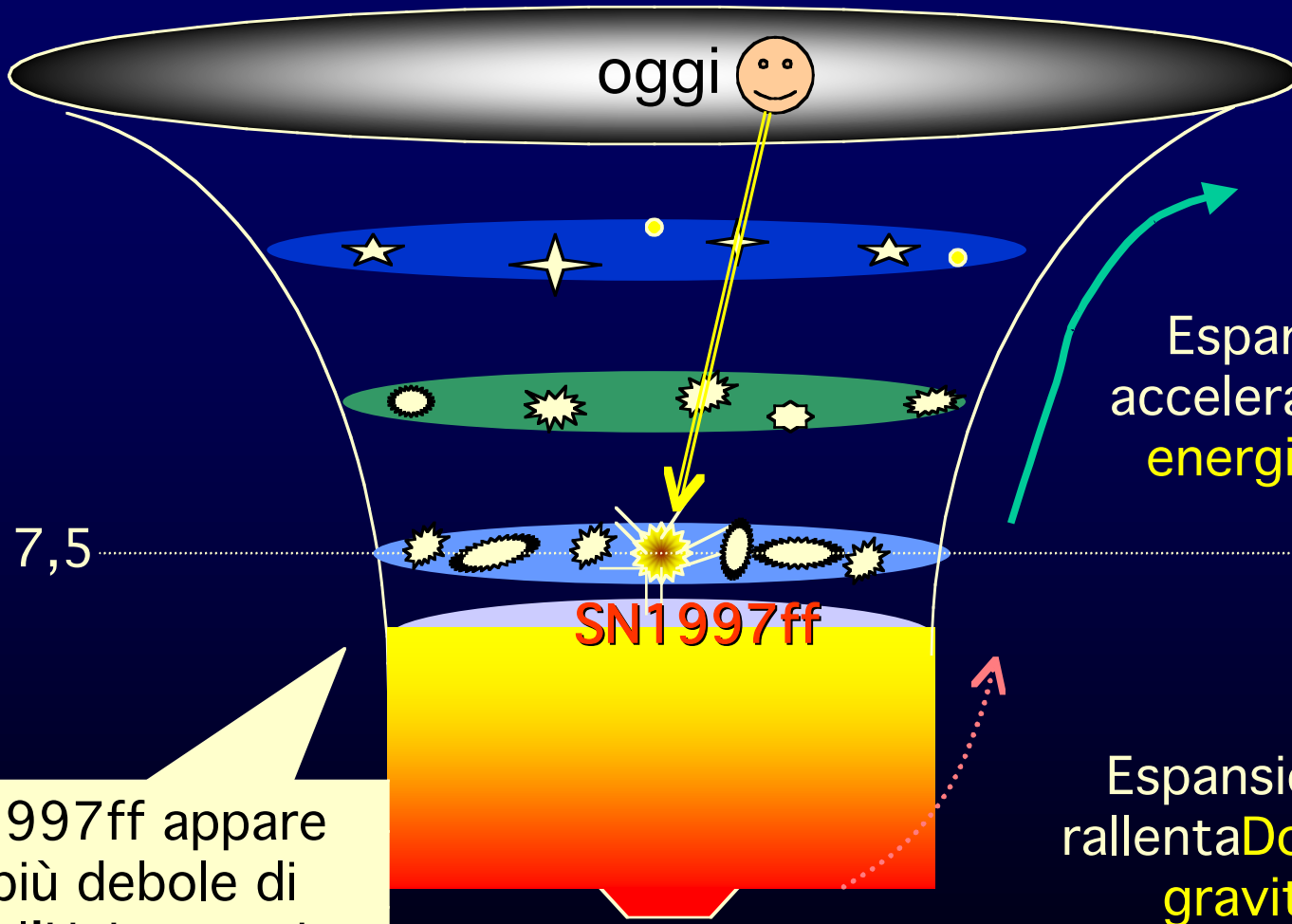






VARIAZIONE DELL'ESPANSIONE DELL'UNIVERSO

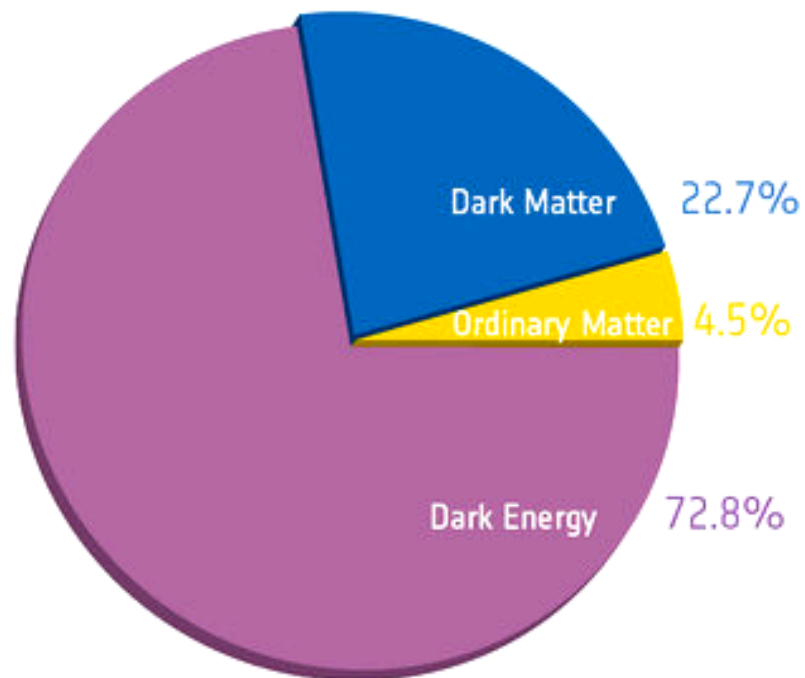
Tempo (0-15 miliardi di anni)



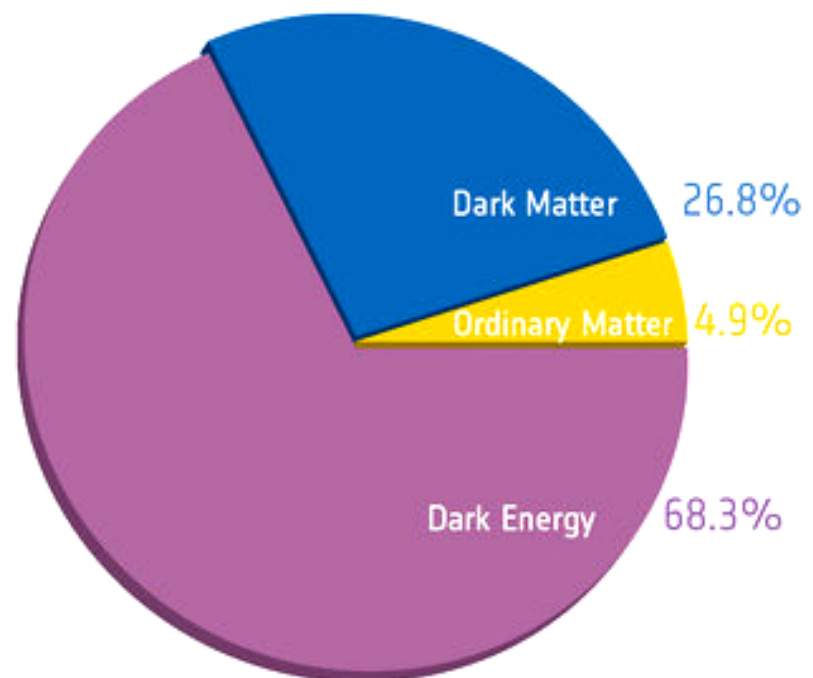
La SN1997ff appare molto più debole di quanto l'Universo si fosse espanso in modo costante.

Big-Bang

Gli ingredienti dell' Universo



Prima di Planck



Dopo Planck

EQUAZIONI DI EINSTEIN

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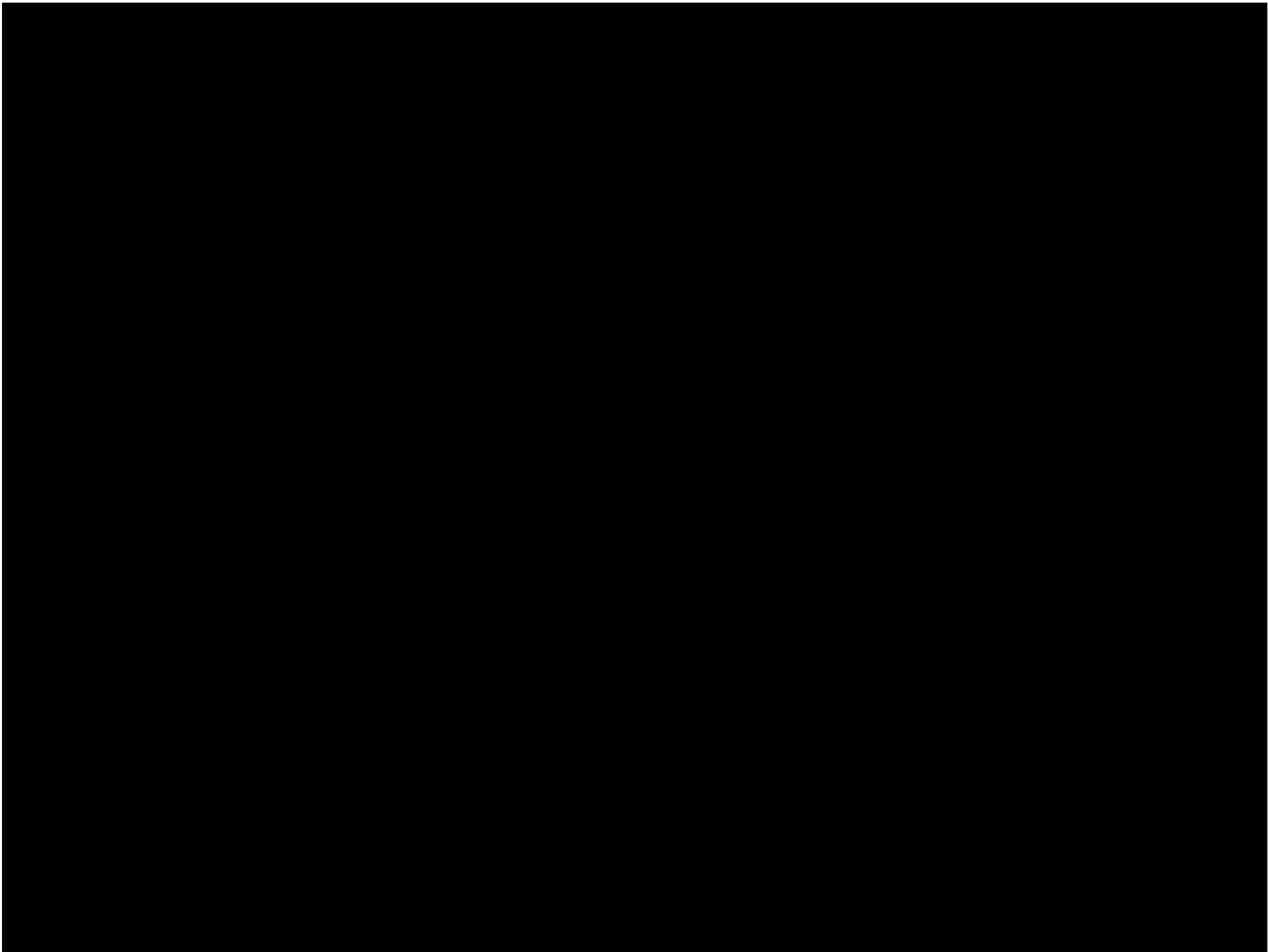
teletrasporto

FOX *Retro*

© CBS Paramount

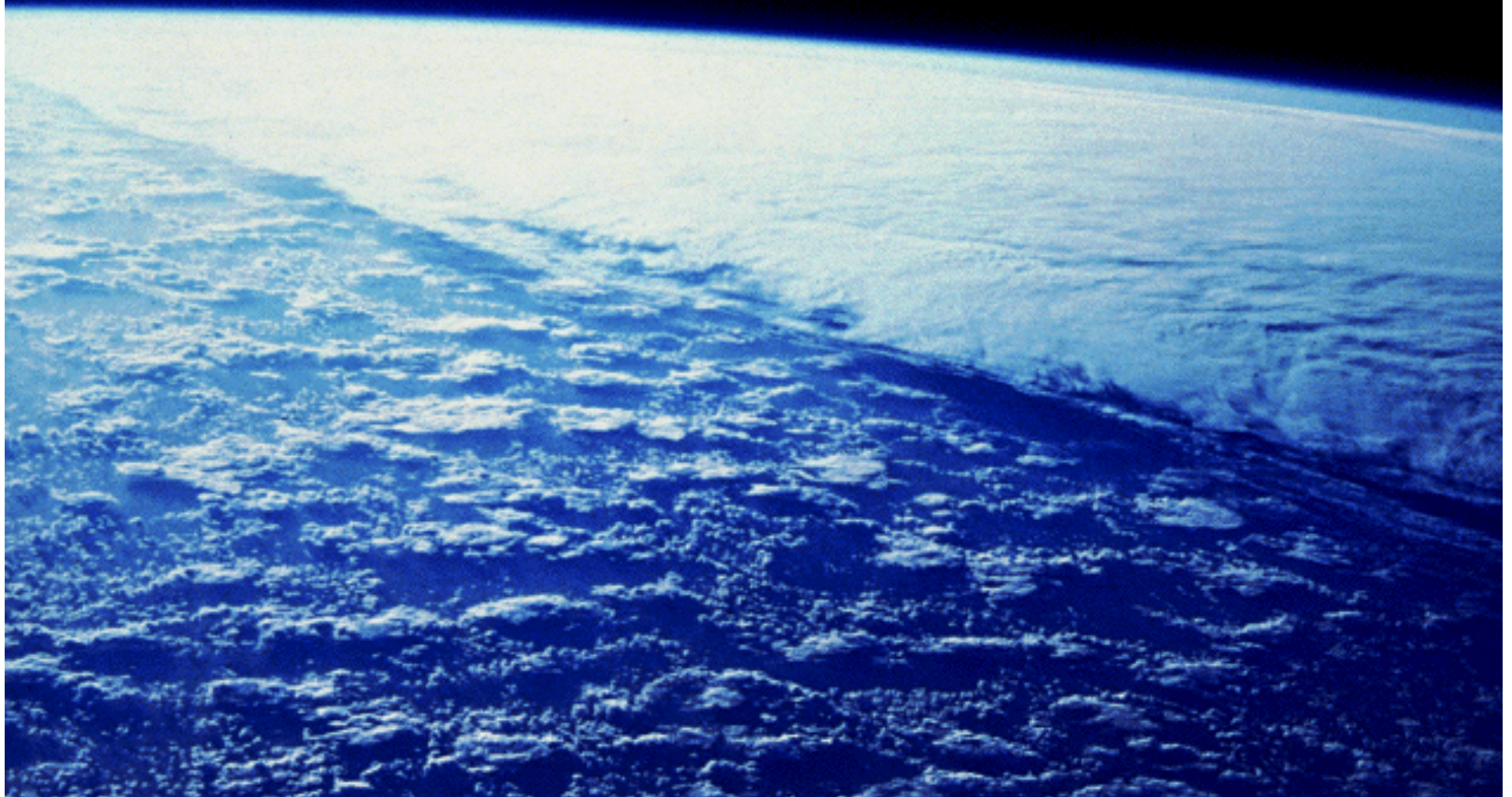






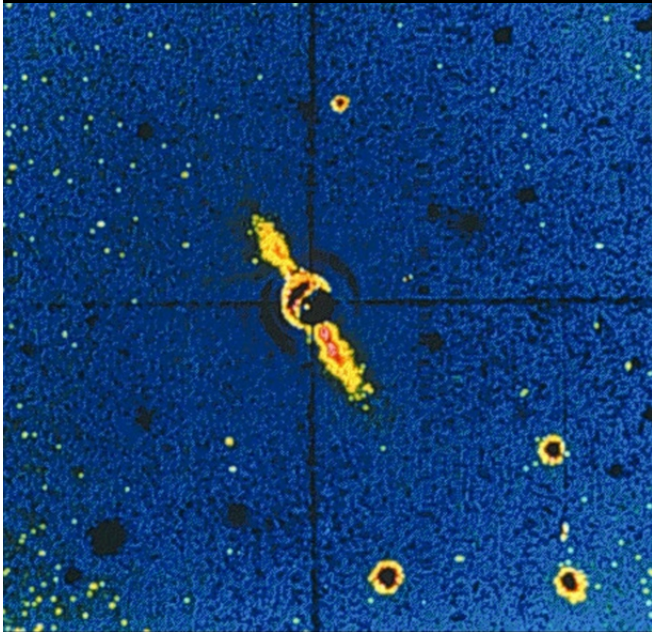
VITA: ULTIMA FRONTIERA

Alla ricerca di pianeti abitabili

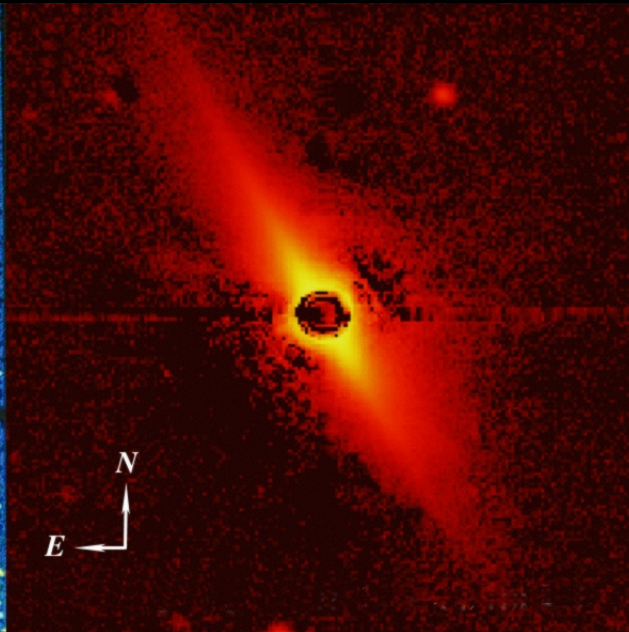




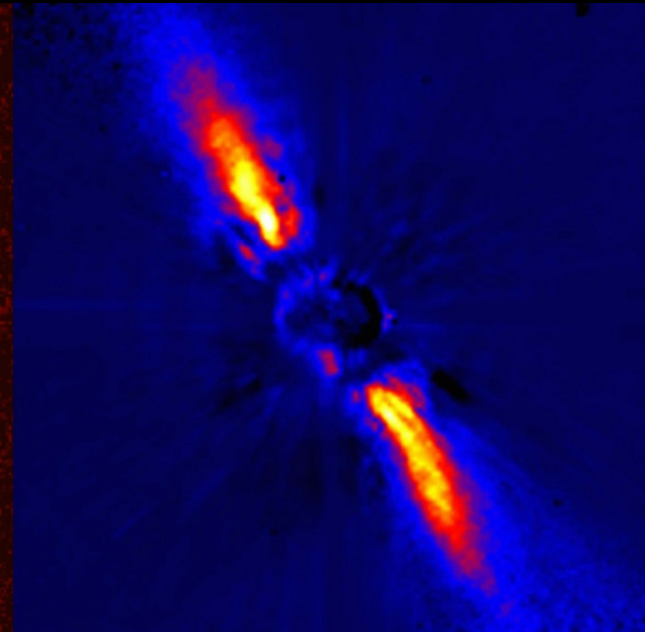
L'anello di polvere di BETA Pictoris....



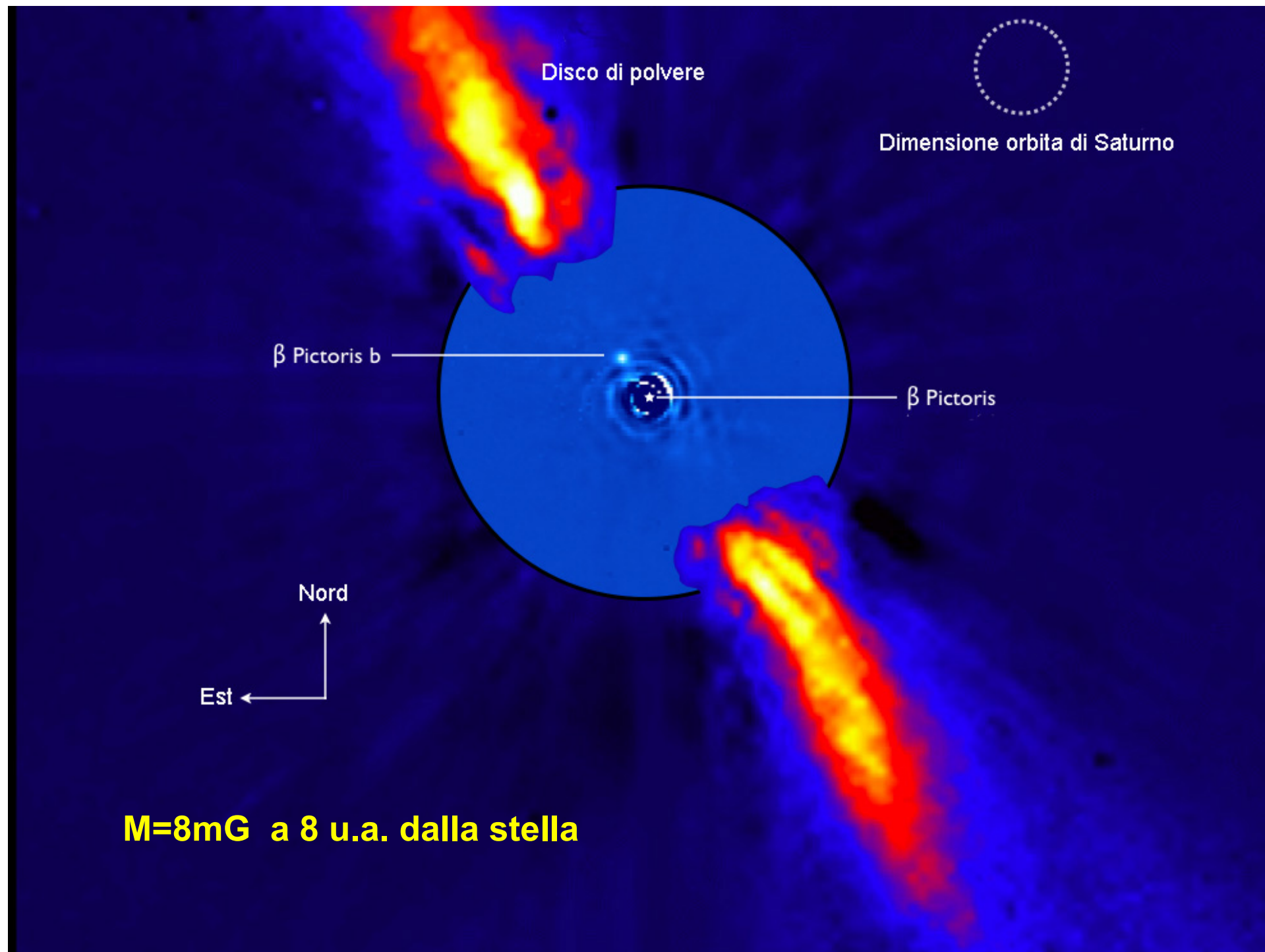
1985, Las Campanas

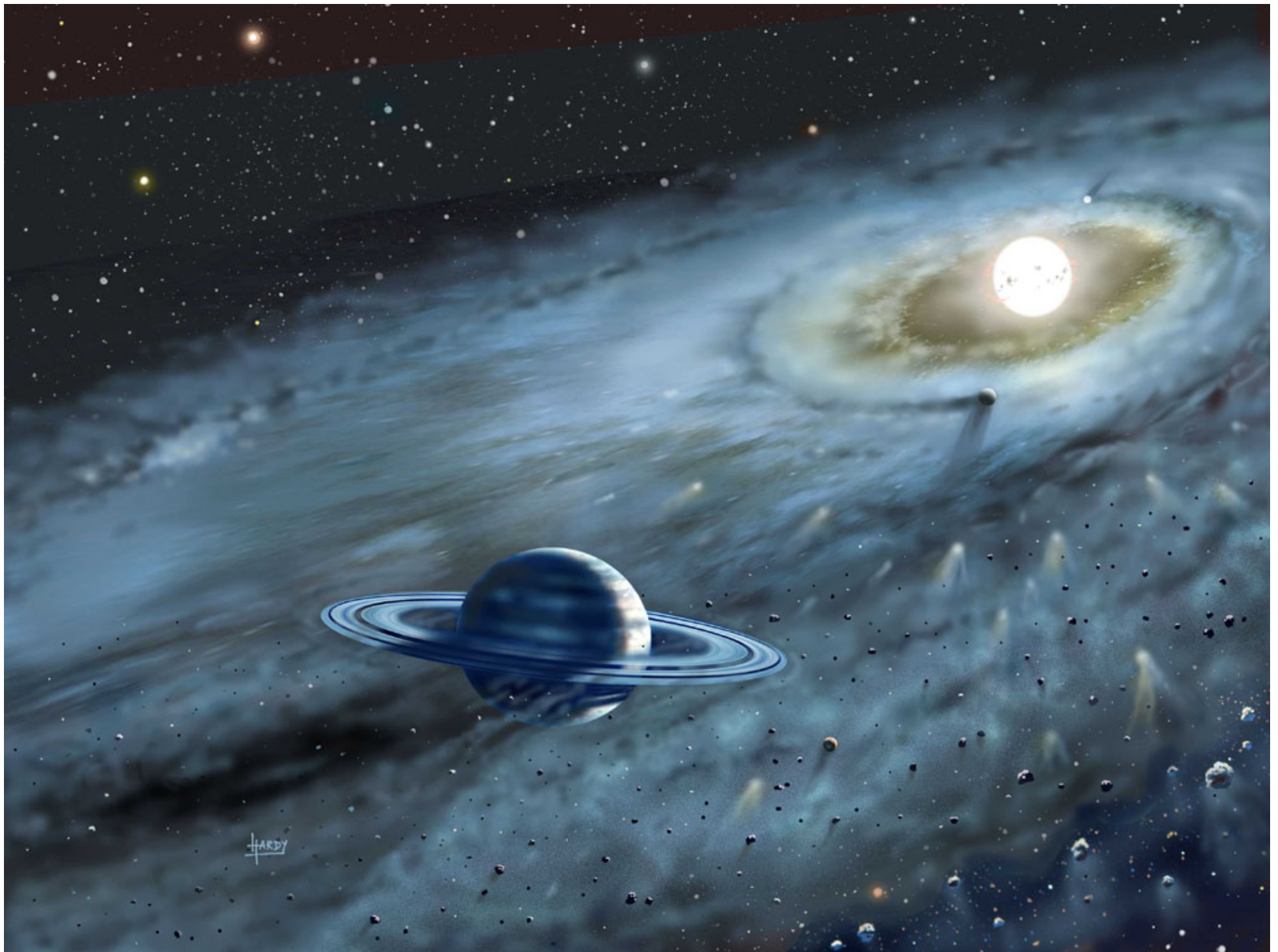


1995, Hawaii

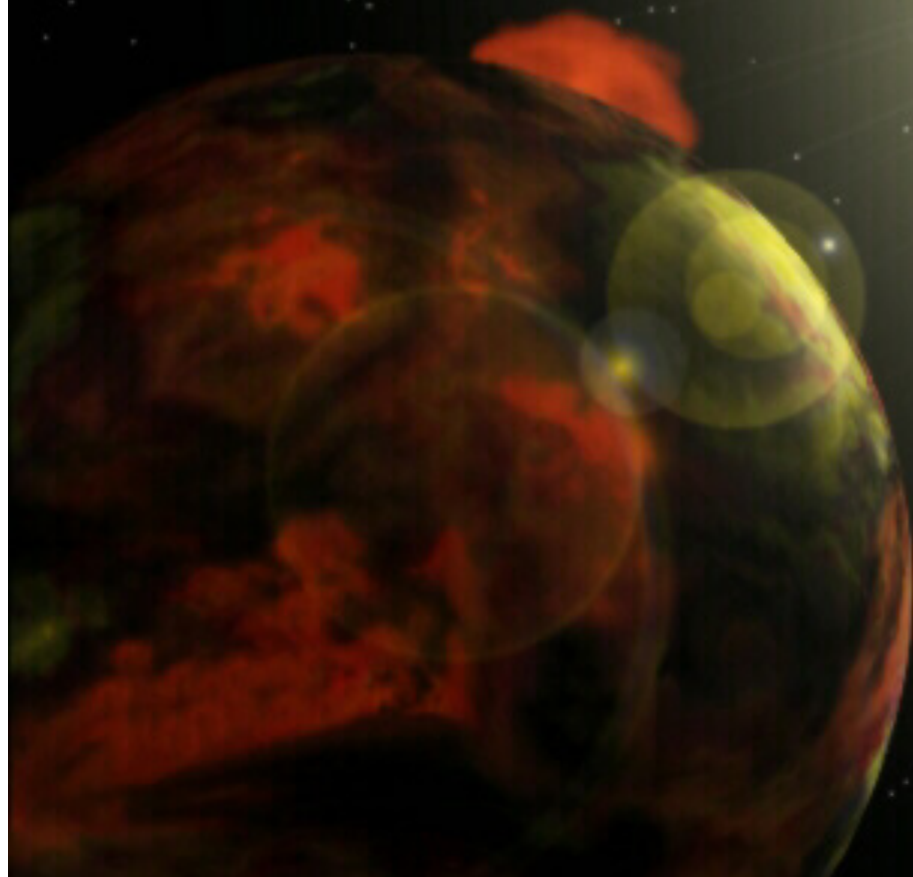


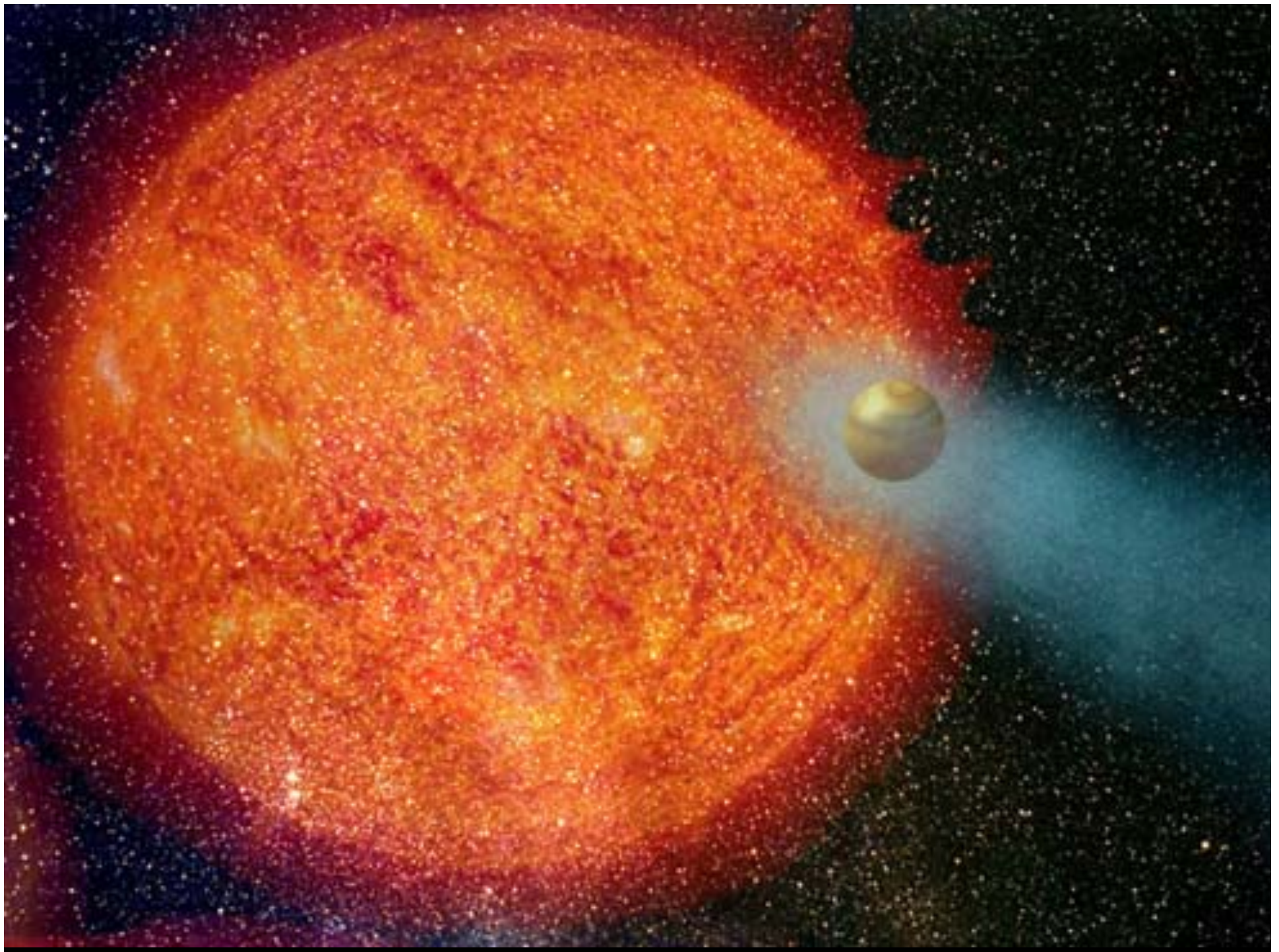
1996, La Silla



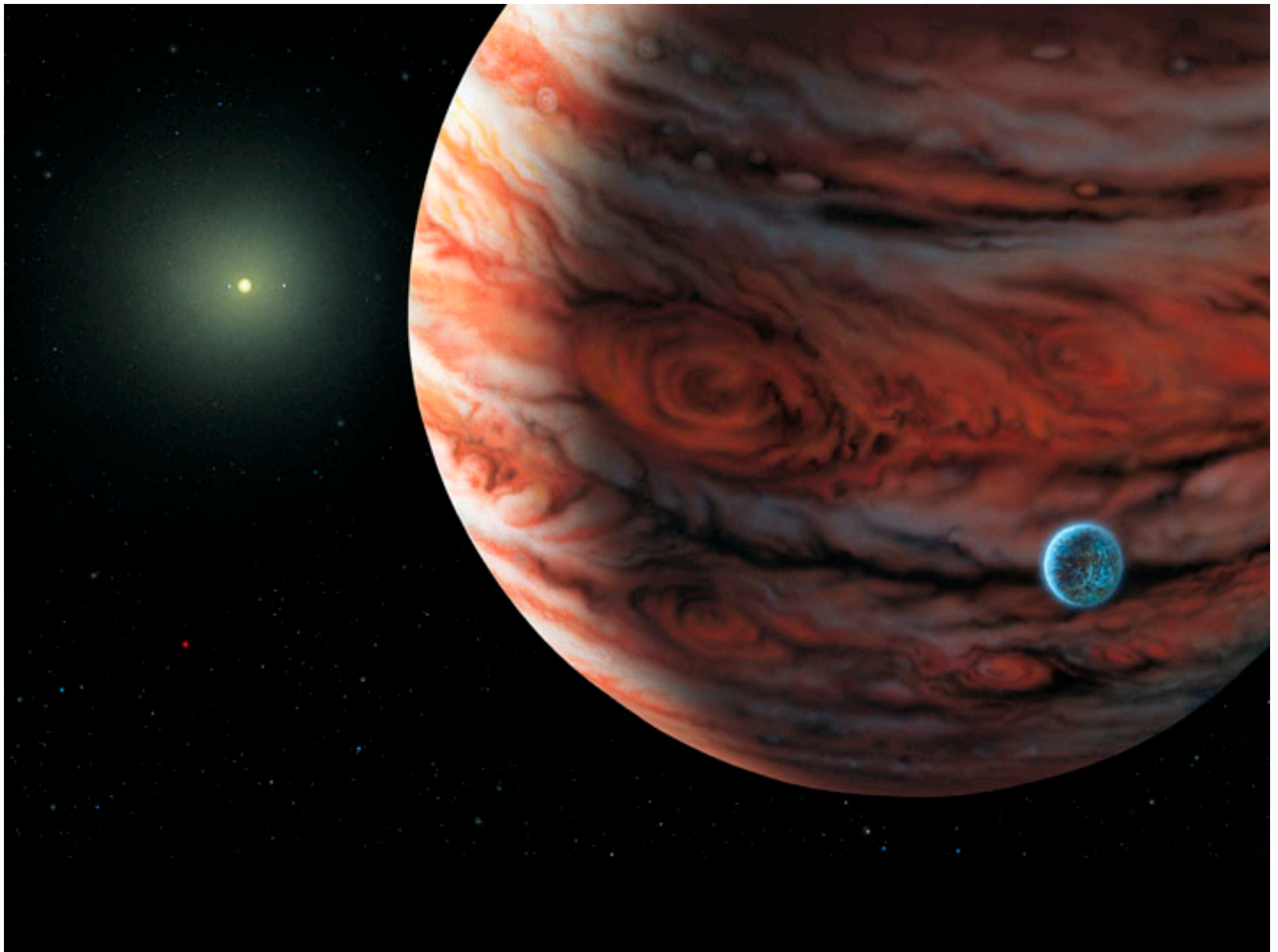


51 PEGASI B

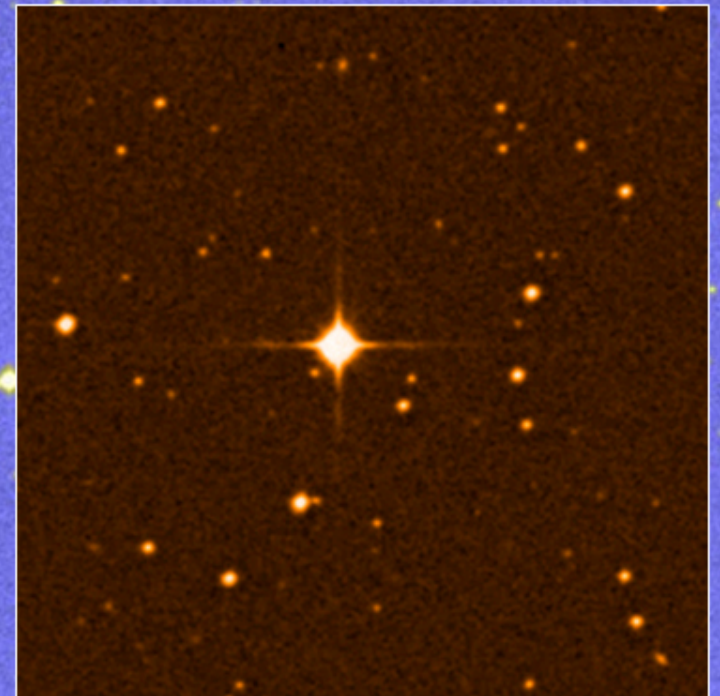
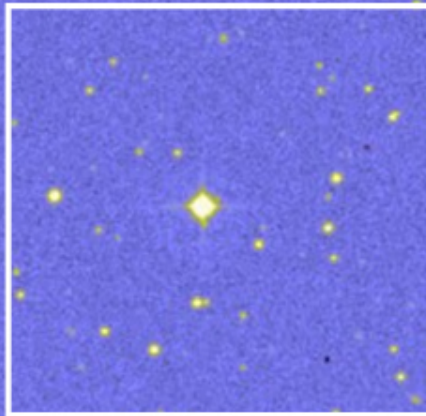


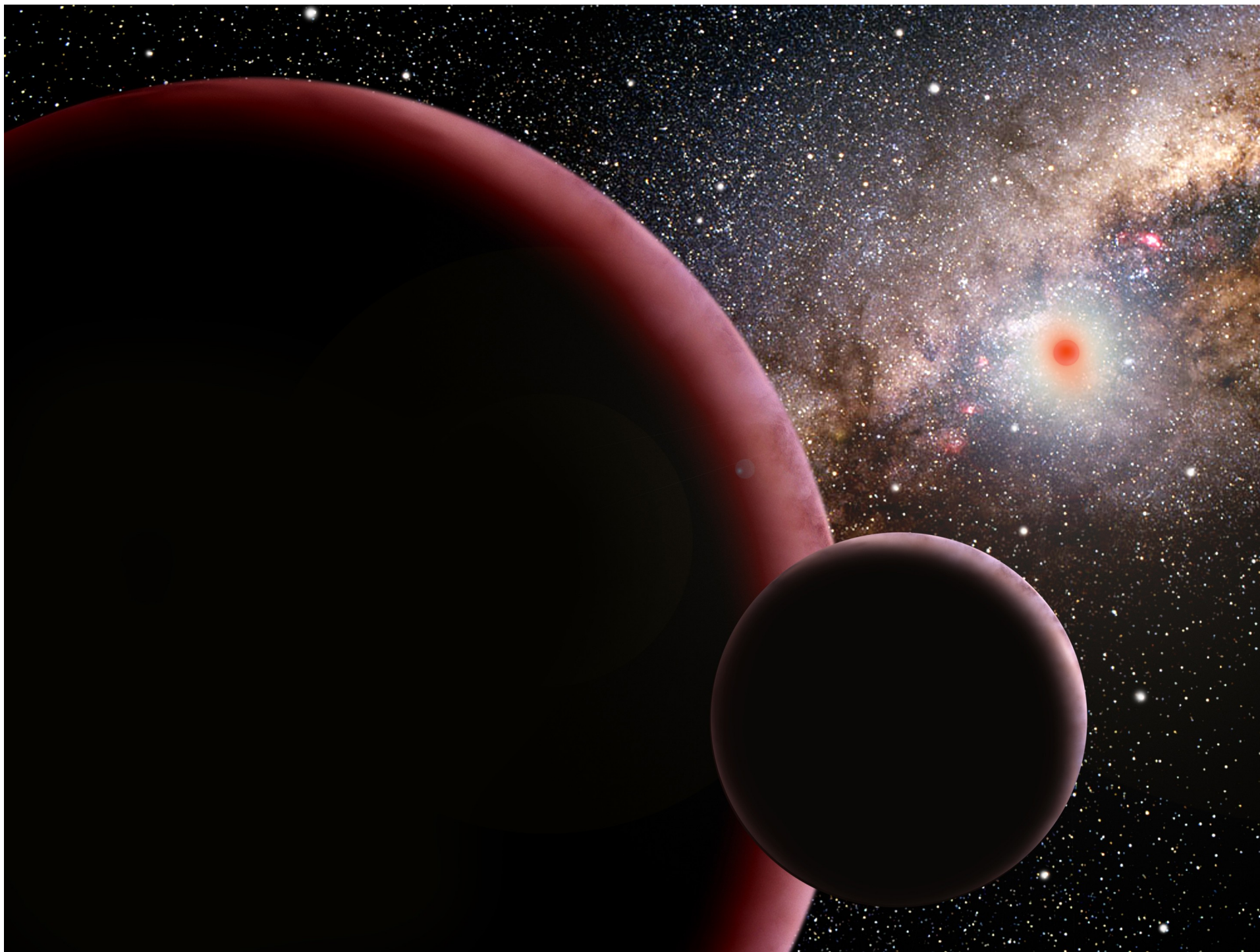




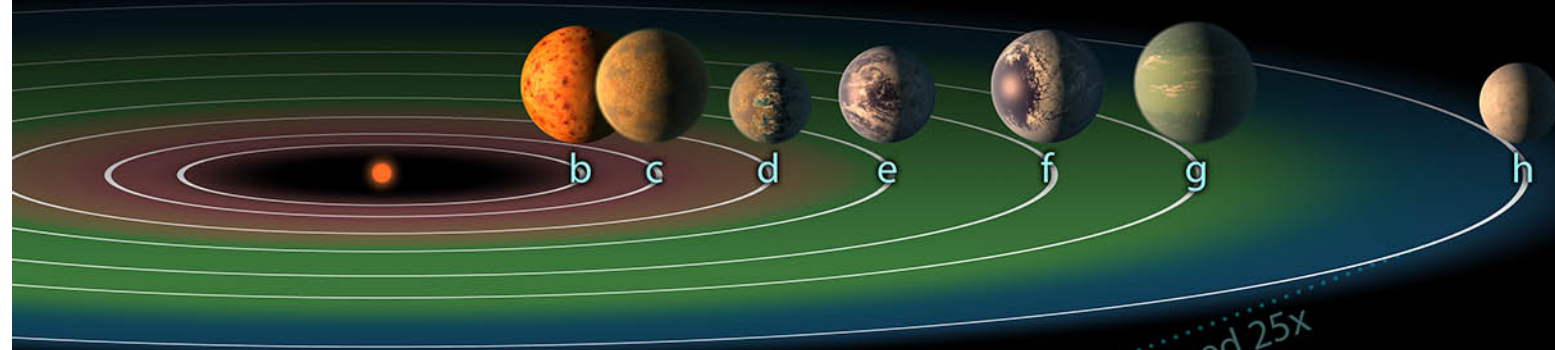


Gliese 581

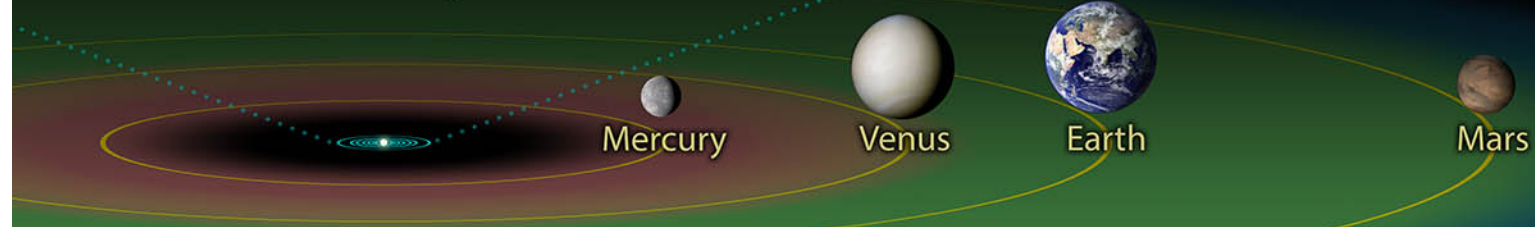




TRAPPIST-1 System



Inner Solar System



Enlarged 25x

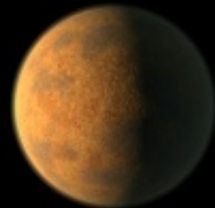
Illustration

TRAPPIST-1 System



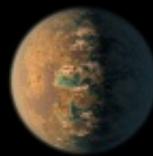
b

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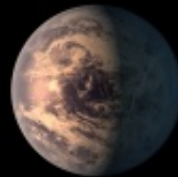
c

ESI = 0.72



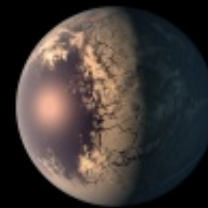
d

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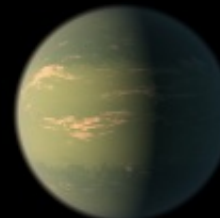
e

ESI = 0.86



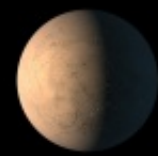
f

ESI = 0.68



g

ESI = 0.58

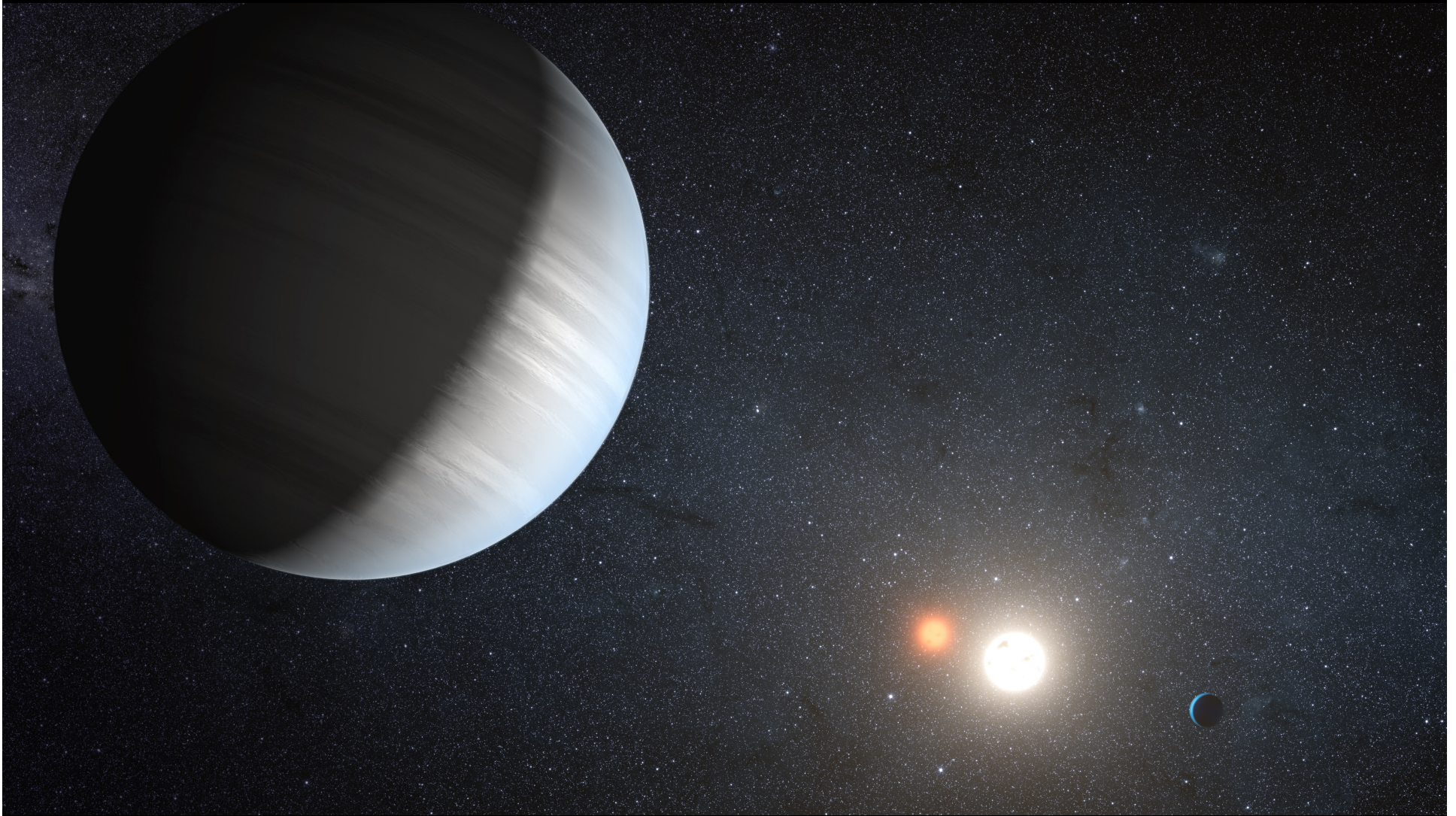


h

ESI = 0.45

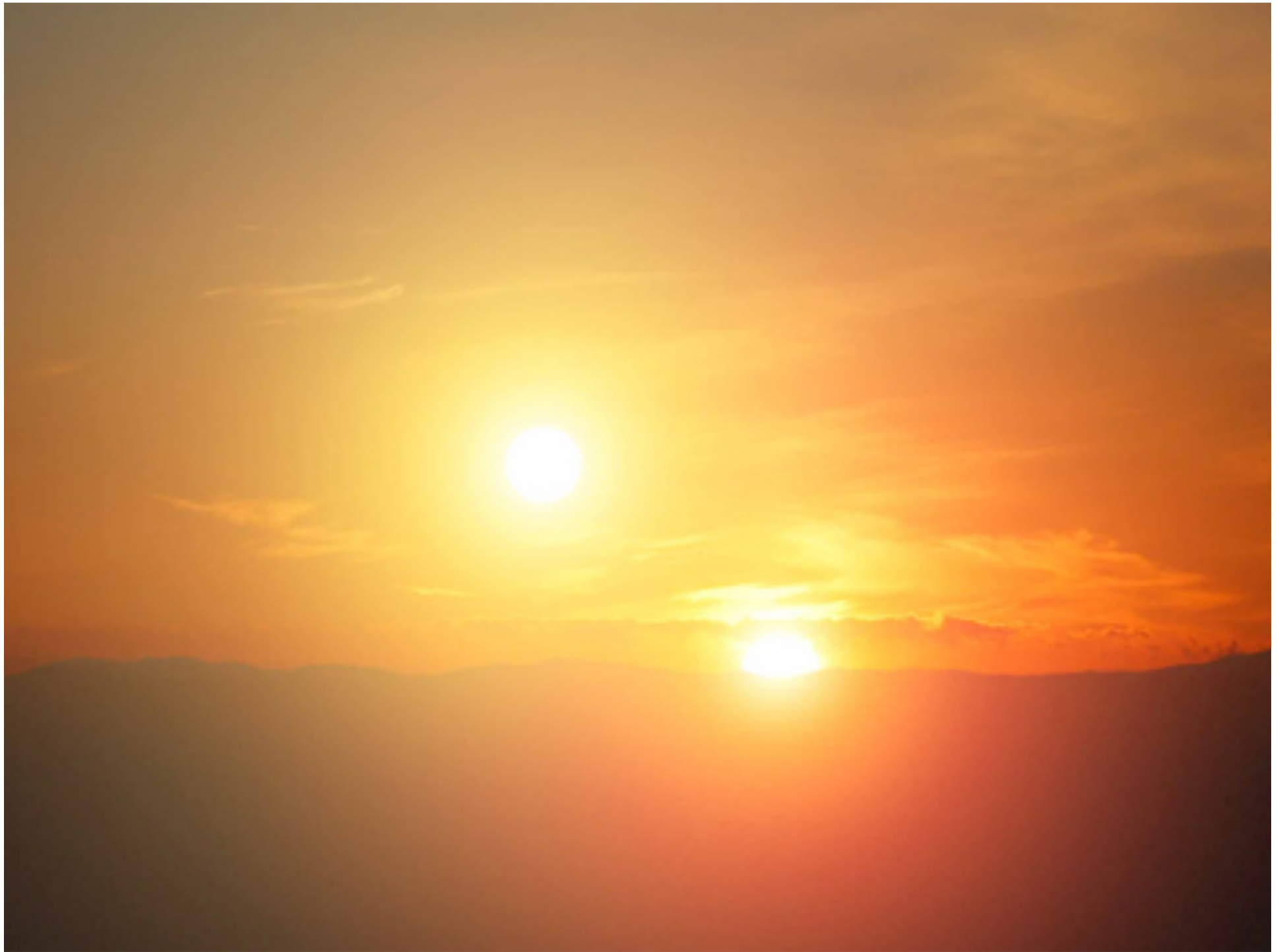
Illustration

Kepler 47

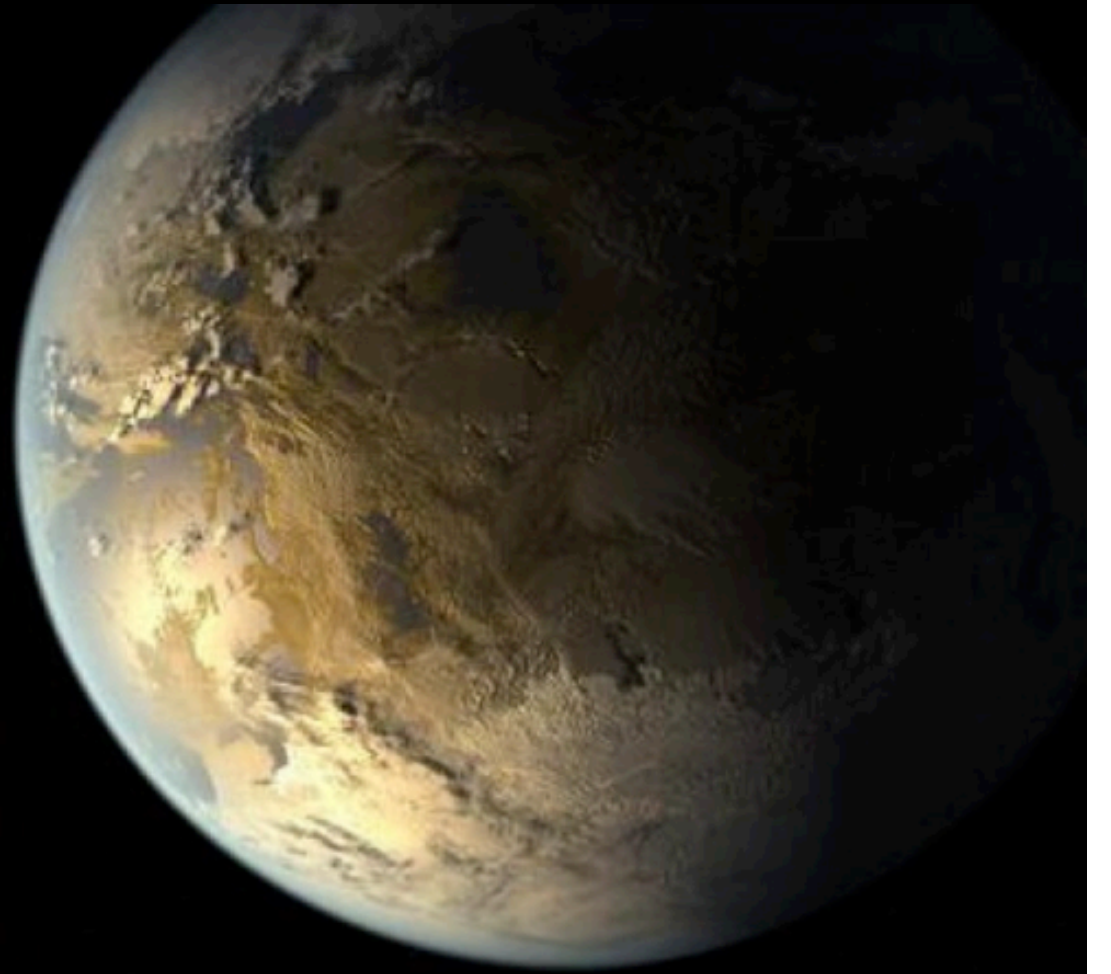


Tatooine





Kepler 186f



















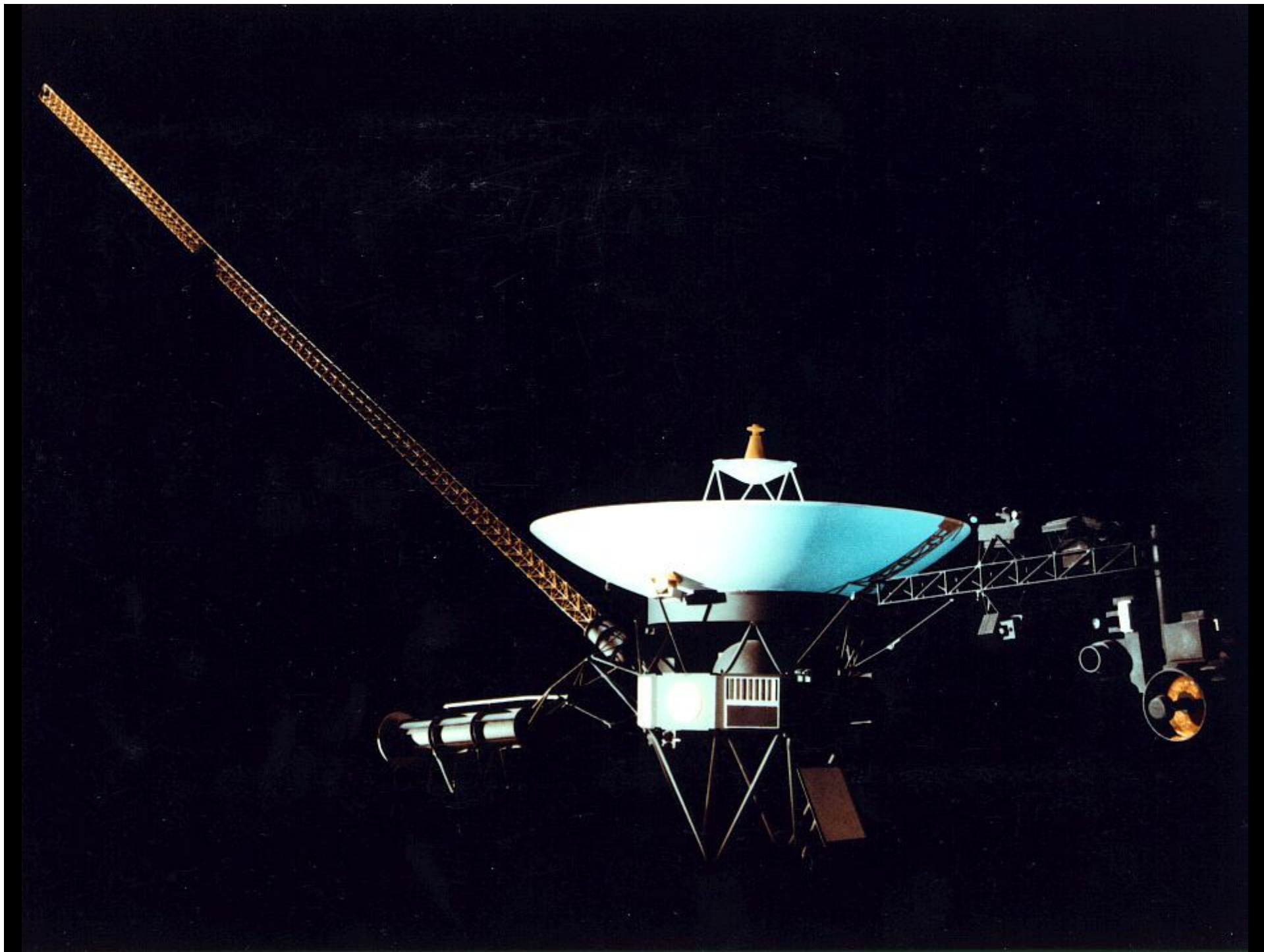




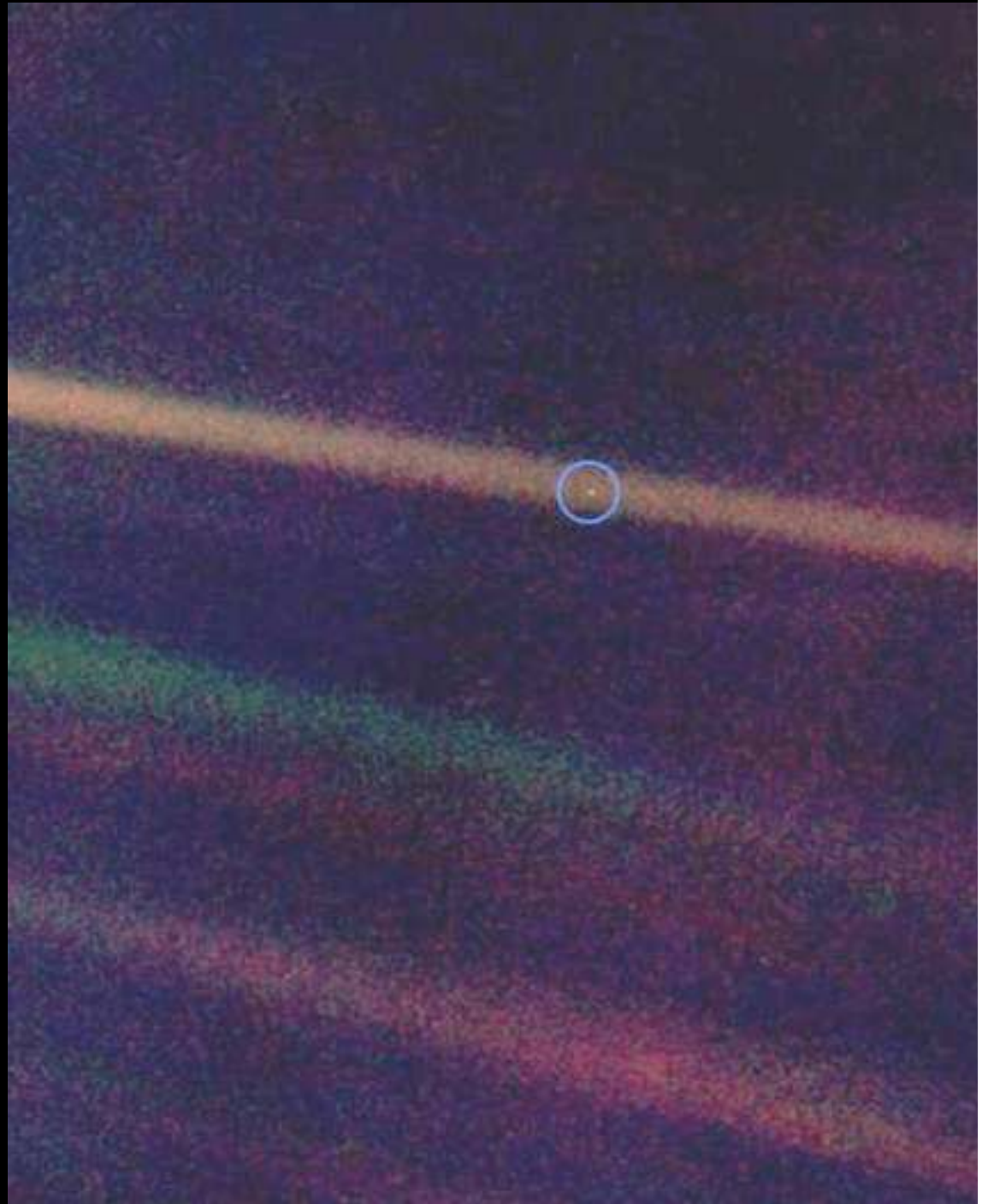
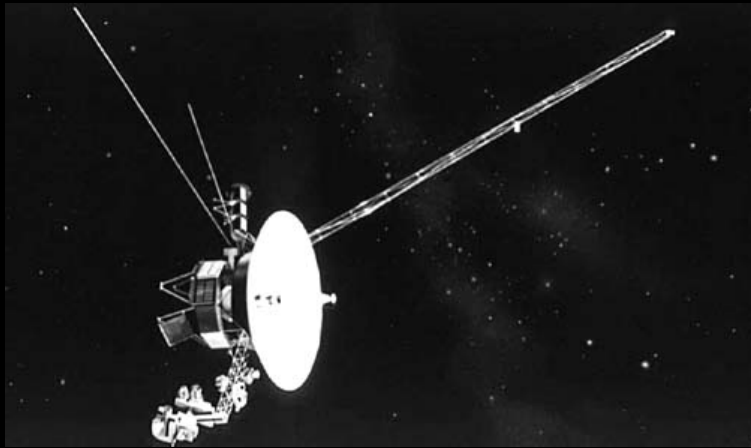


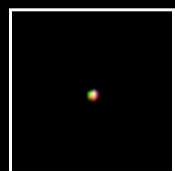




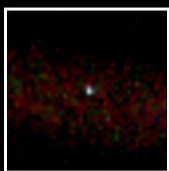


**Voyager 1,
14 Febbraio 1990....**





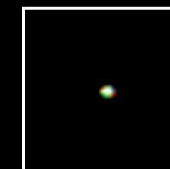
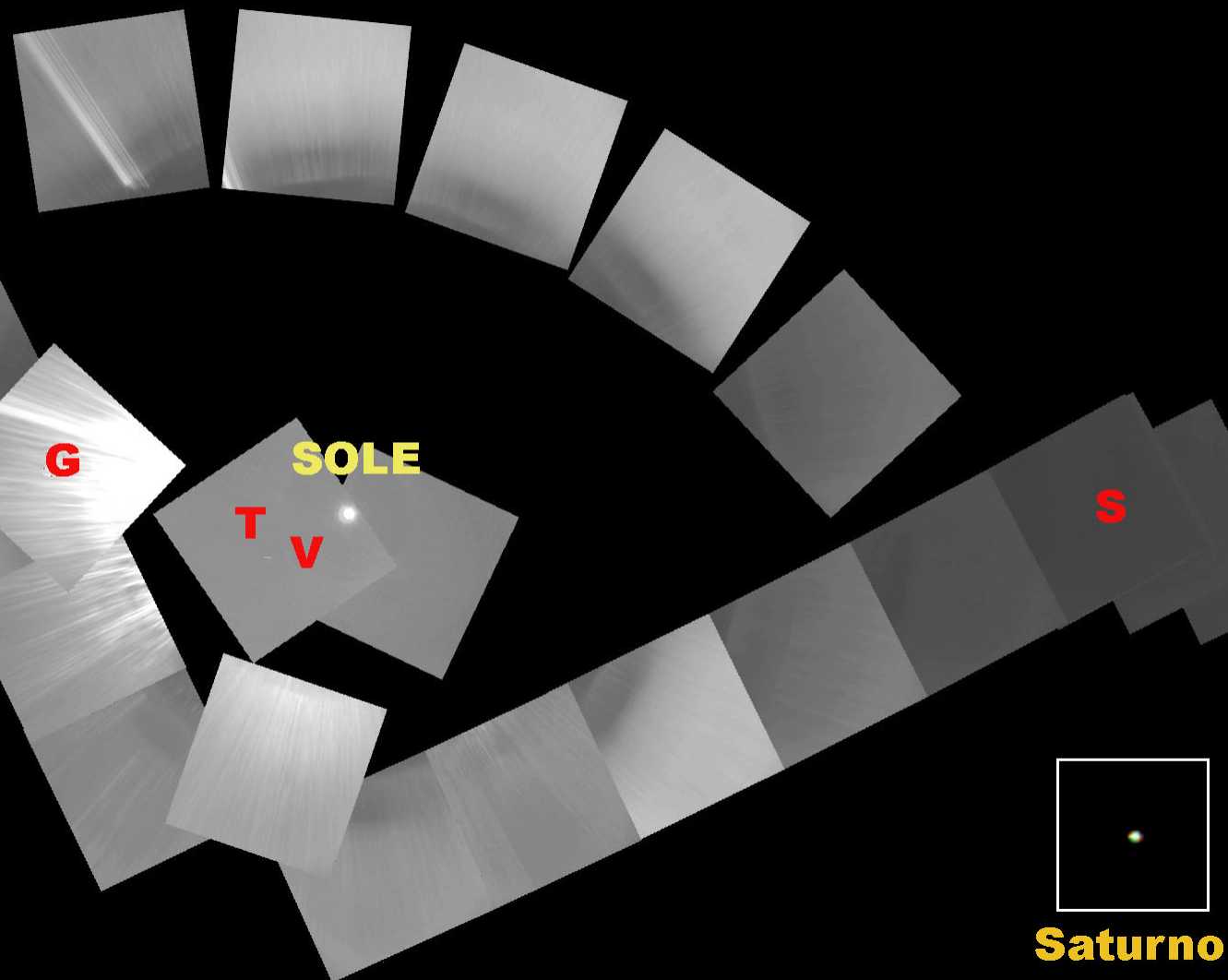
Giove



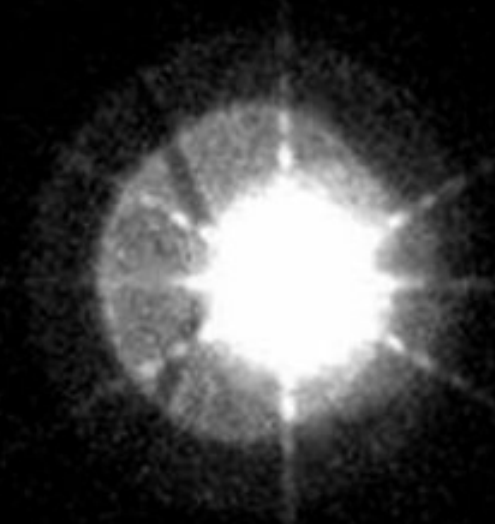
Terra

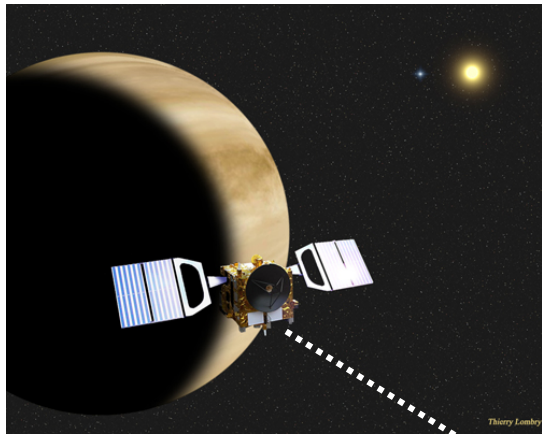


Venere

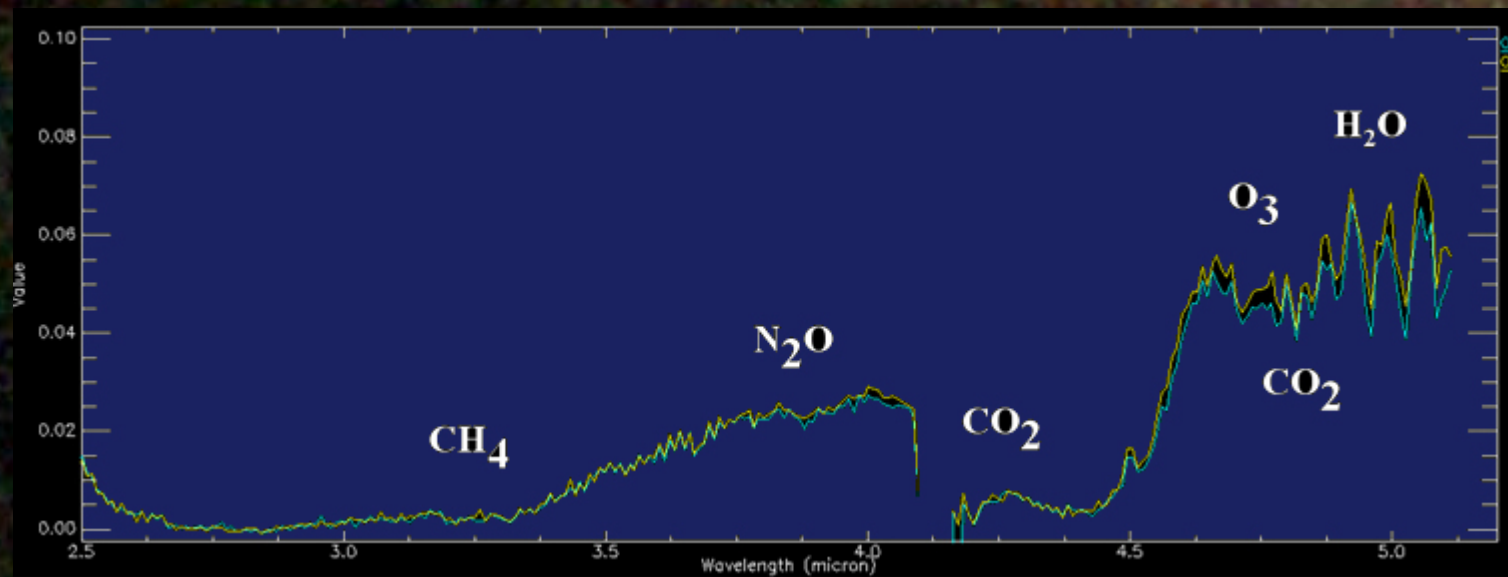


Saturno





Thierry Loubey

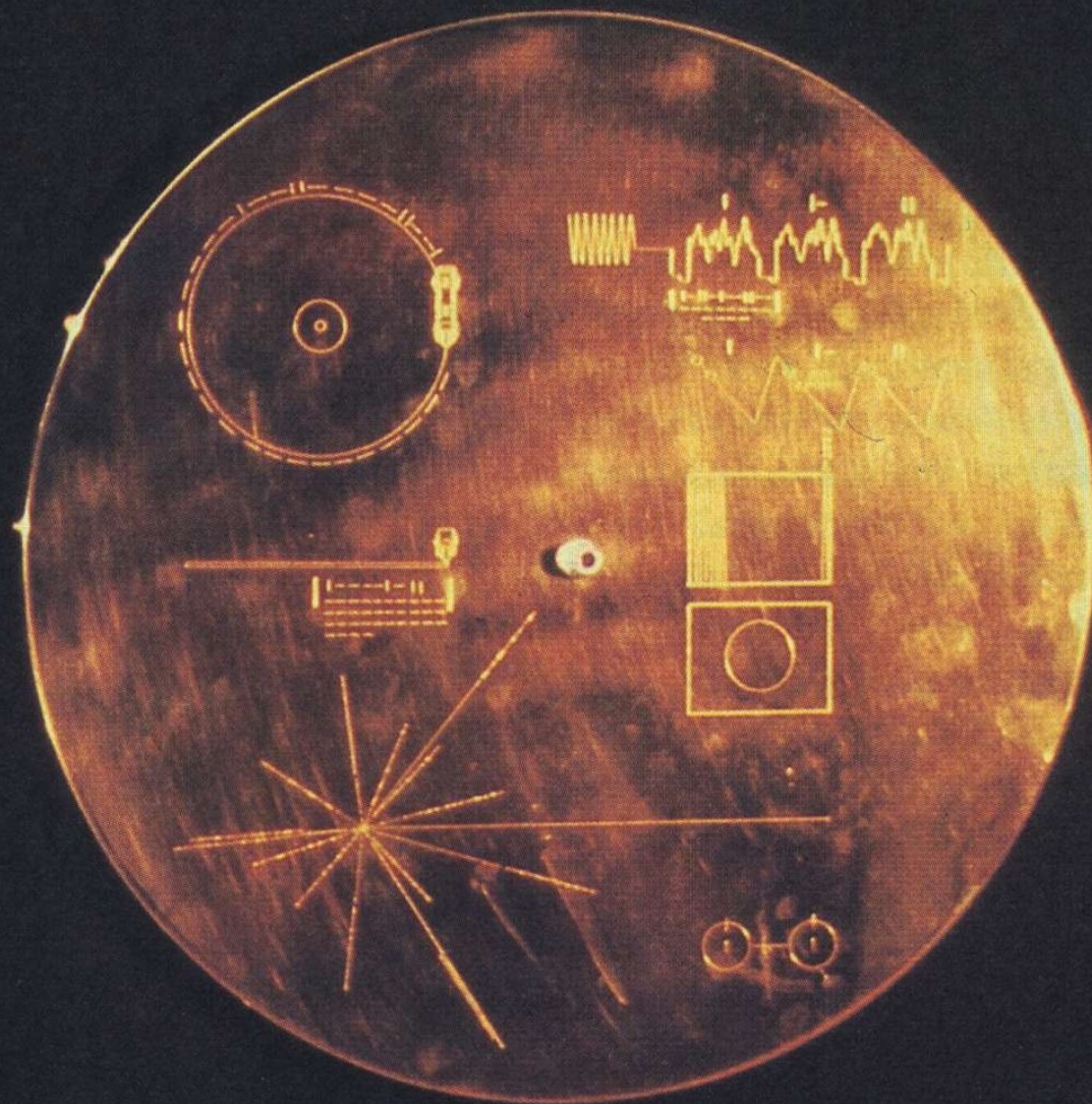


NOMAD



NOMAD finale









Quanti impulsi: $1079 = 73 \times 23$

[illegible]

23

[illegible]

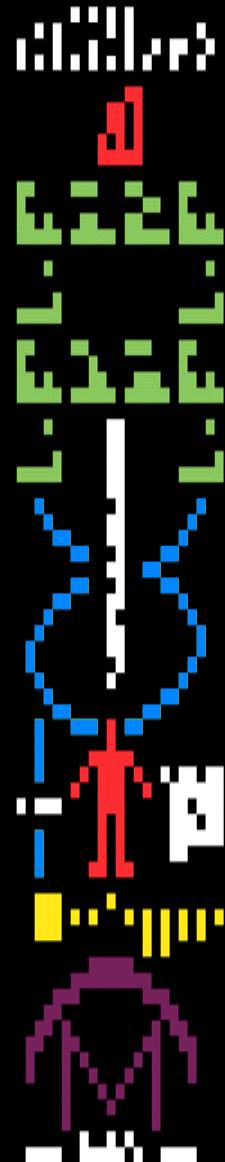
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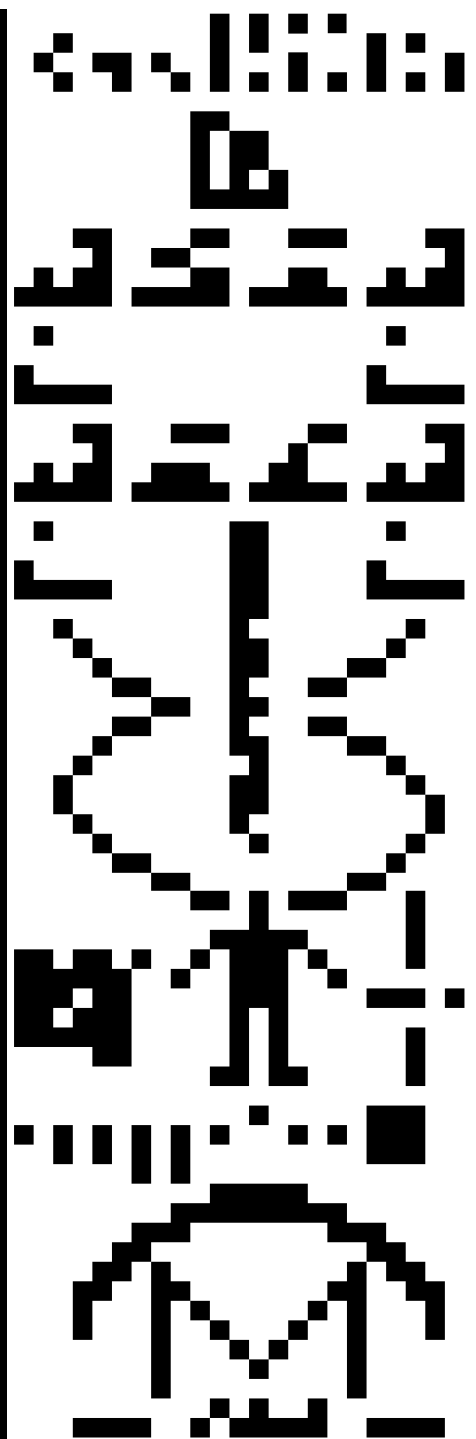
73

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Il messaggio di Arecibo decodificato

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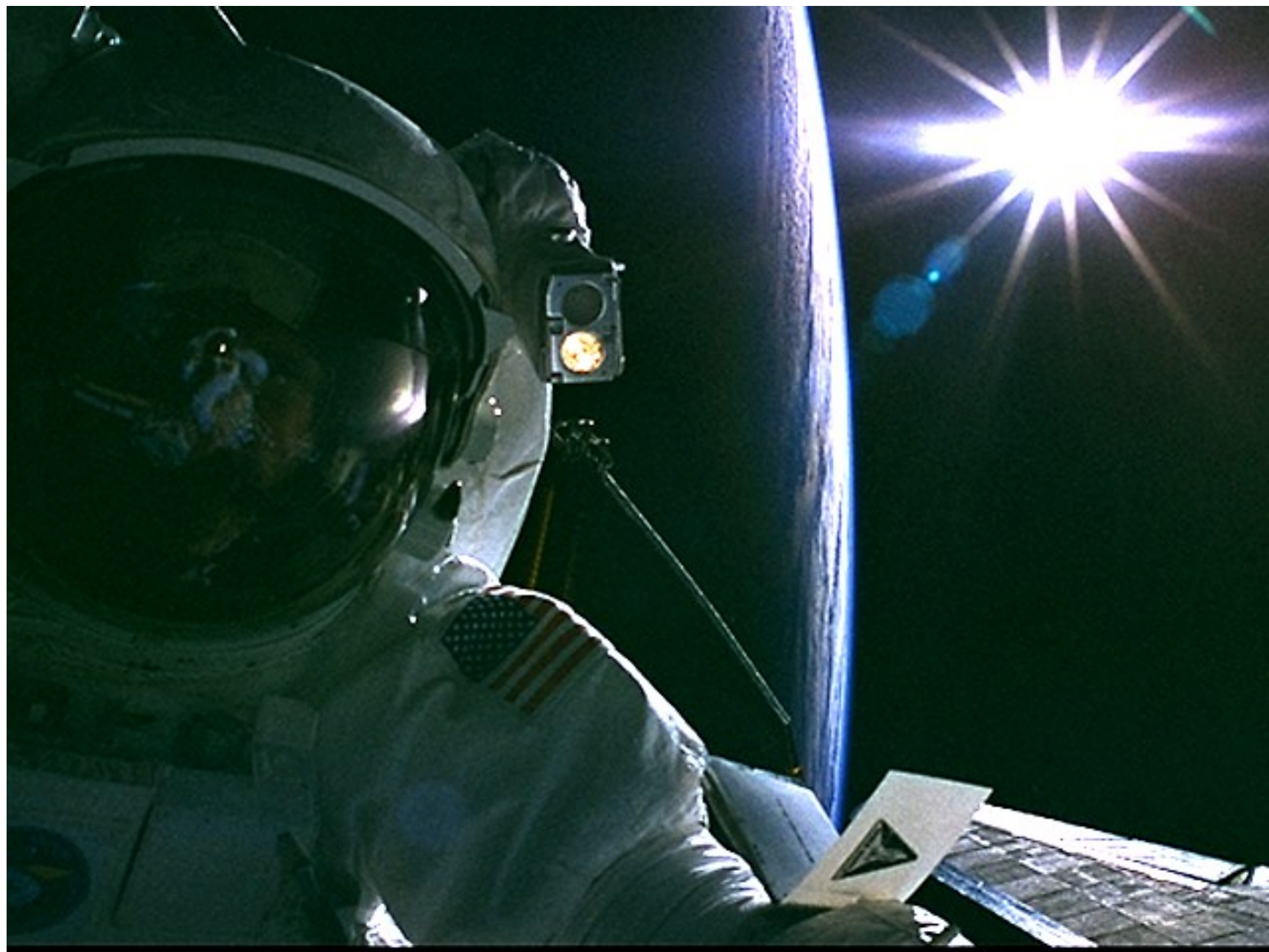




Terra !

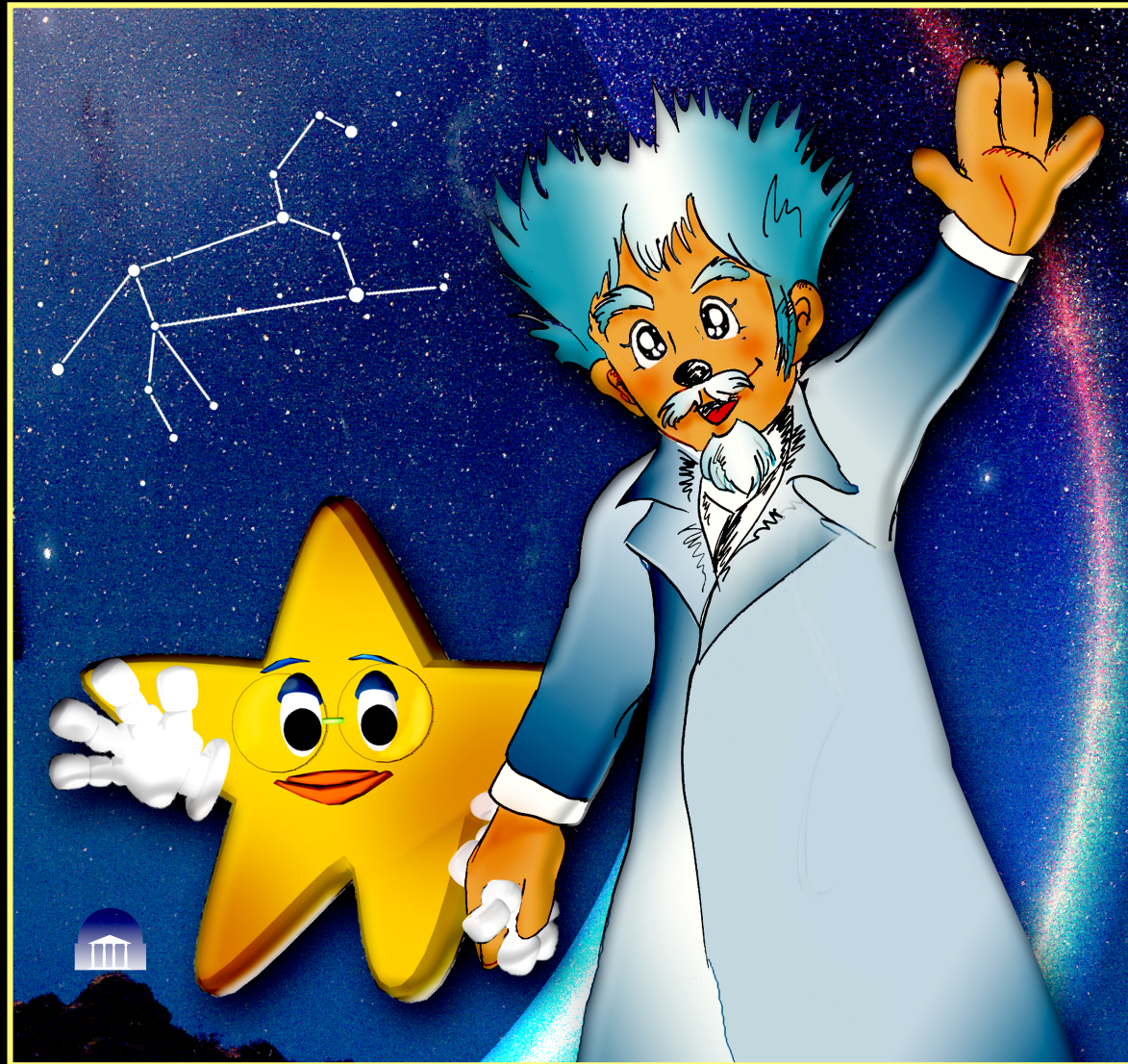


**15 Settembre '06: gli anelli vecchi e nuovi di Saturno visti dalla sonda CASSINI
in controluce (Sole dietro il disco del pianeta)**





CIAO A TUTTI !



Fabio Peri