Das interstellare Medium

Montags: 15:15 – 16:00

Keine Vorlesung: 12.6.06

Spitzer:
Physical Processes in the Interstellar Medium
(Wiley 1998)

Lequeux:
The Interstellar Medium
(A&A Library, 2005)

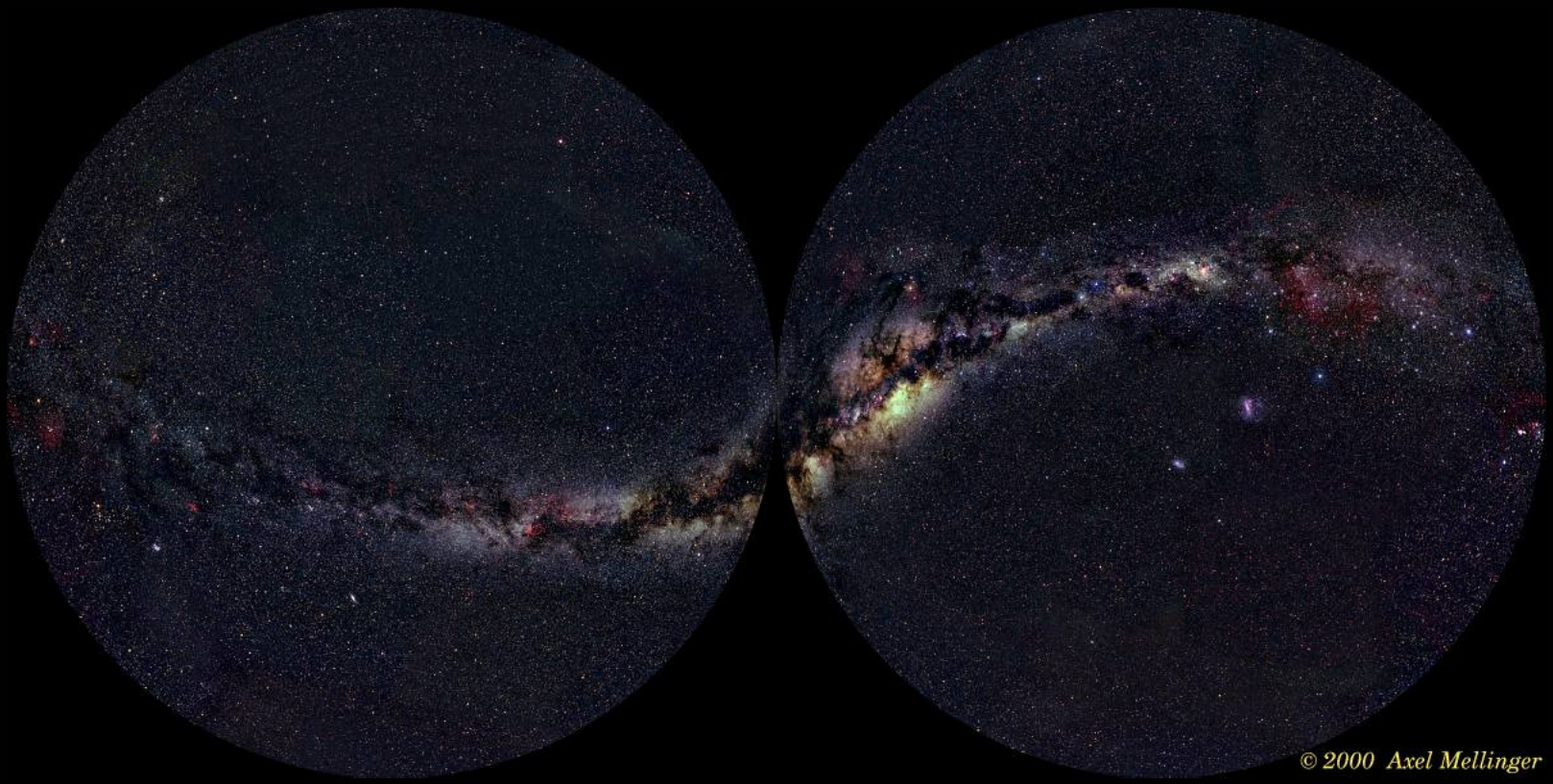
http://www.usm.uni-muenchen.de/people/burkert/lectures/ism/intro.html

Die Milchstrasse

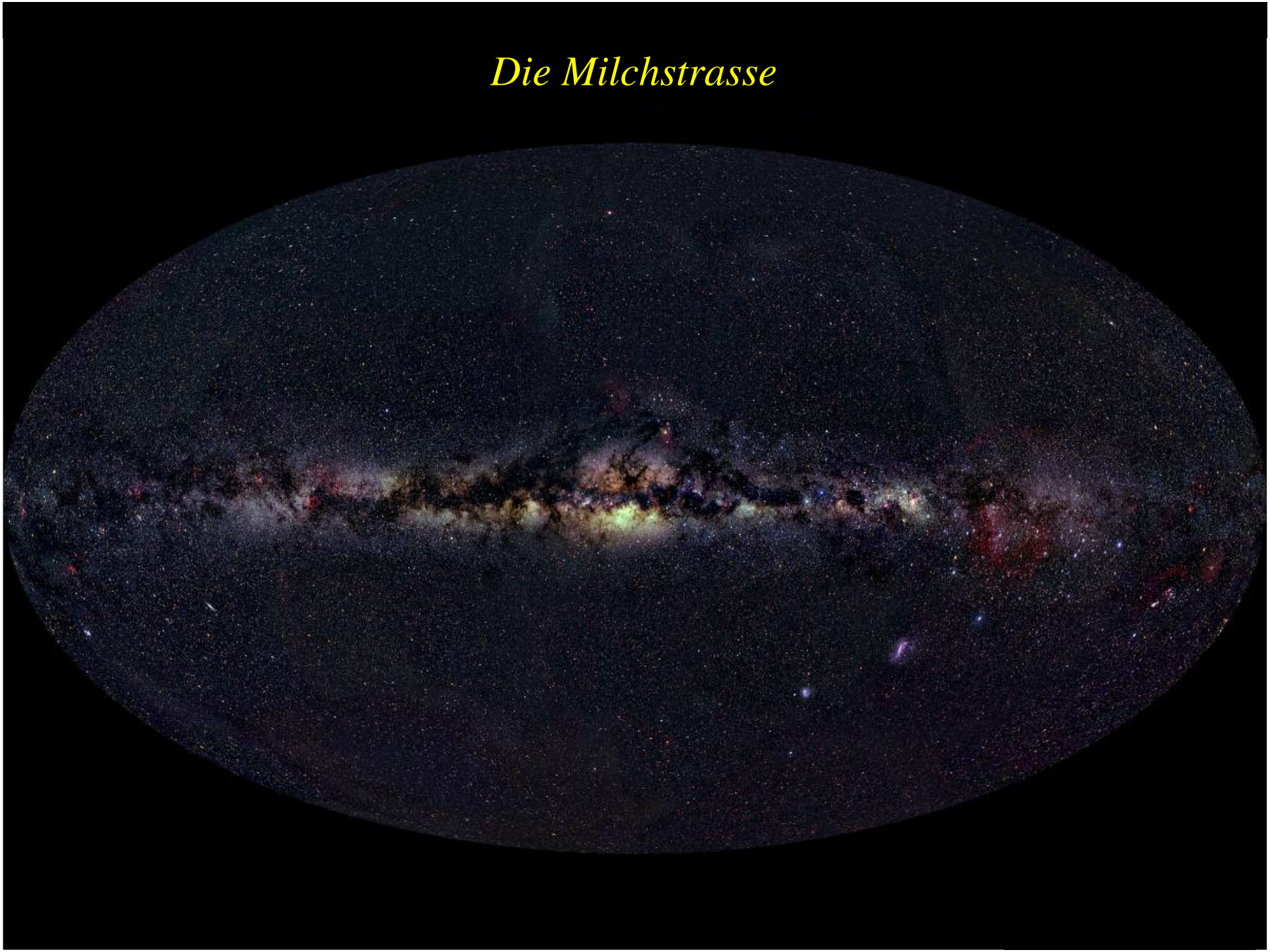
Nördliche Hemisphäre

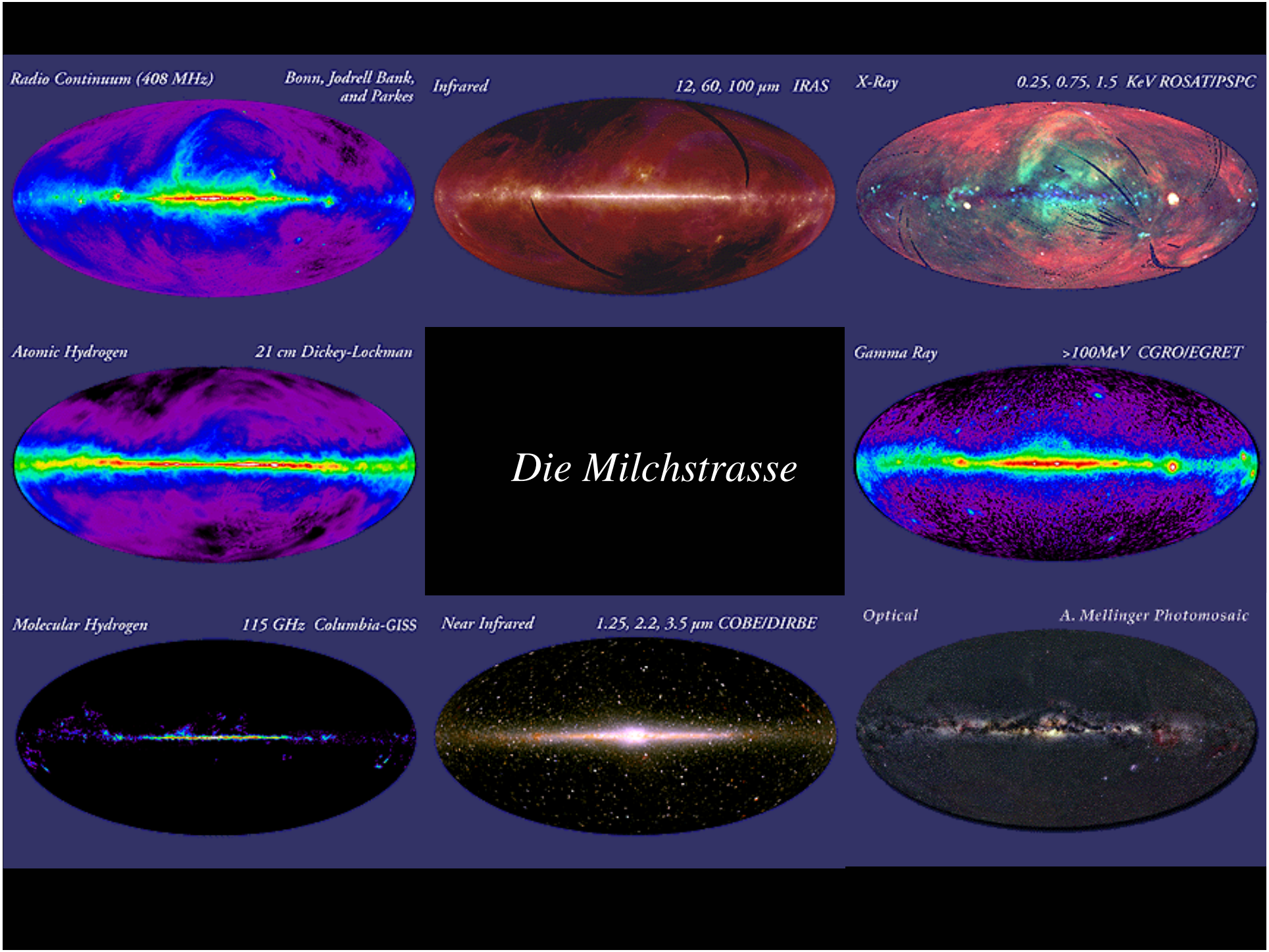
Die Milchstrasse

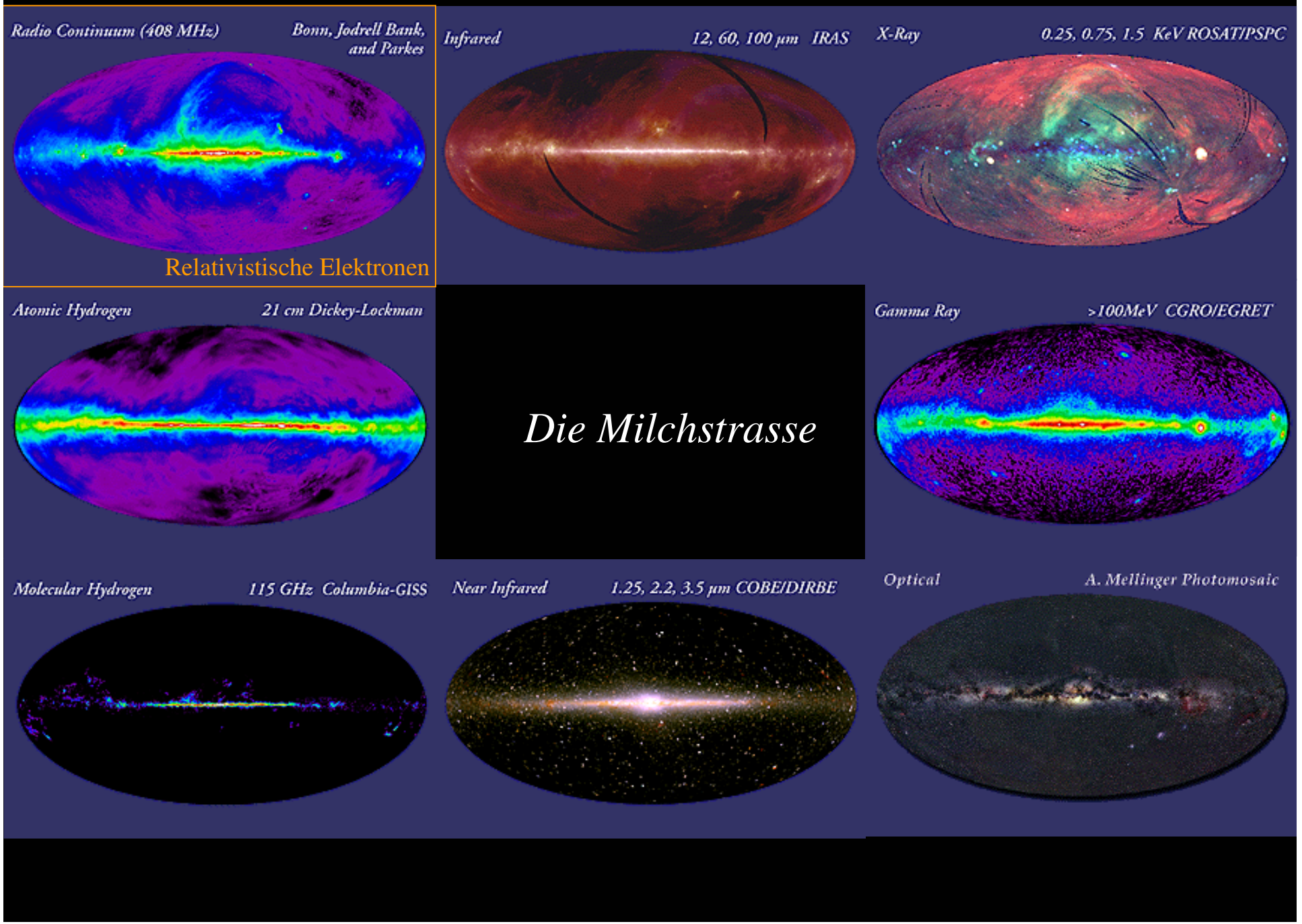
Nördliche Hemisphäre *Südliche Hemisphäre*

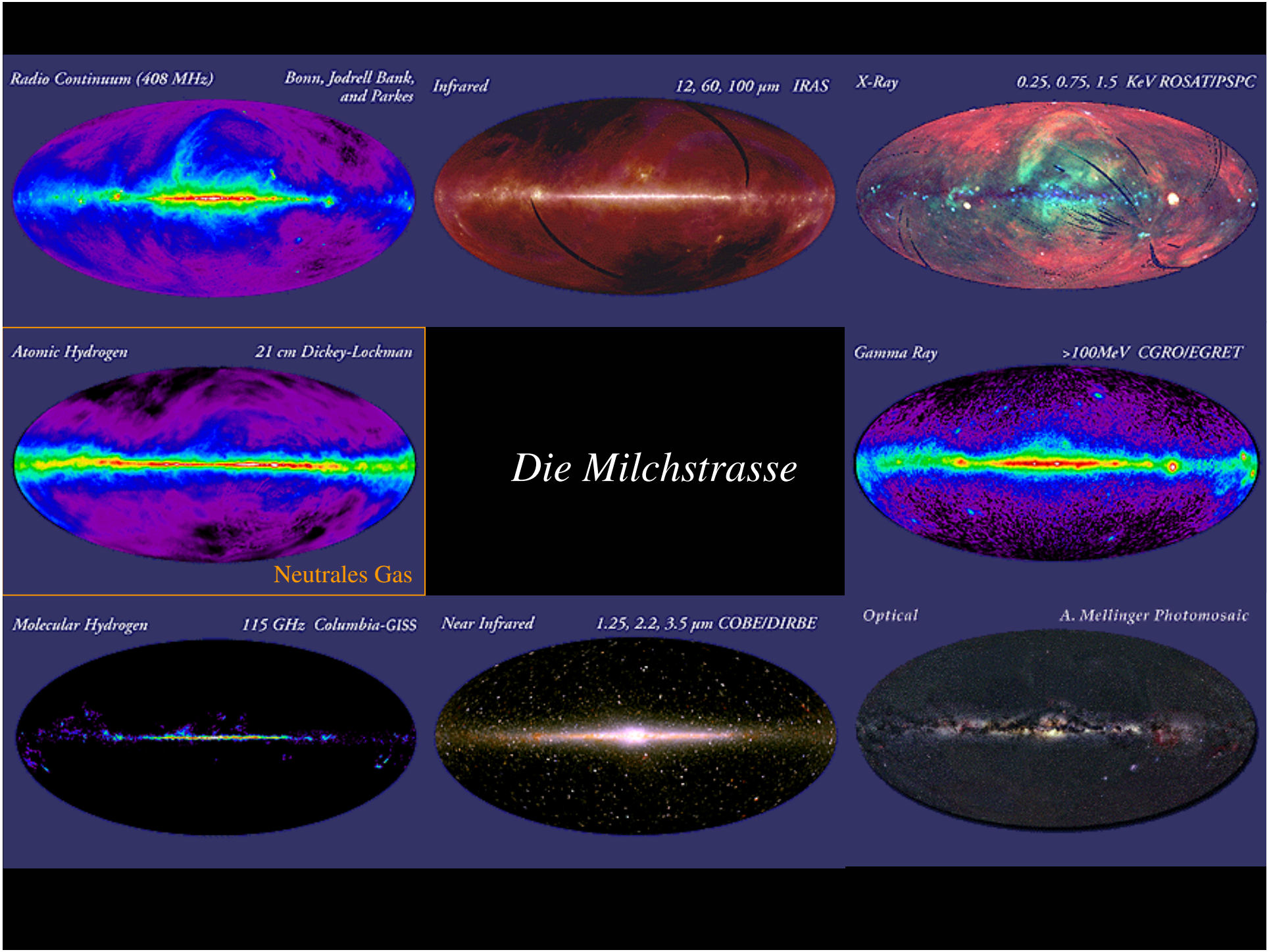


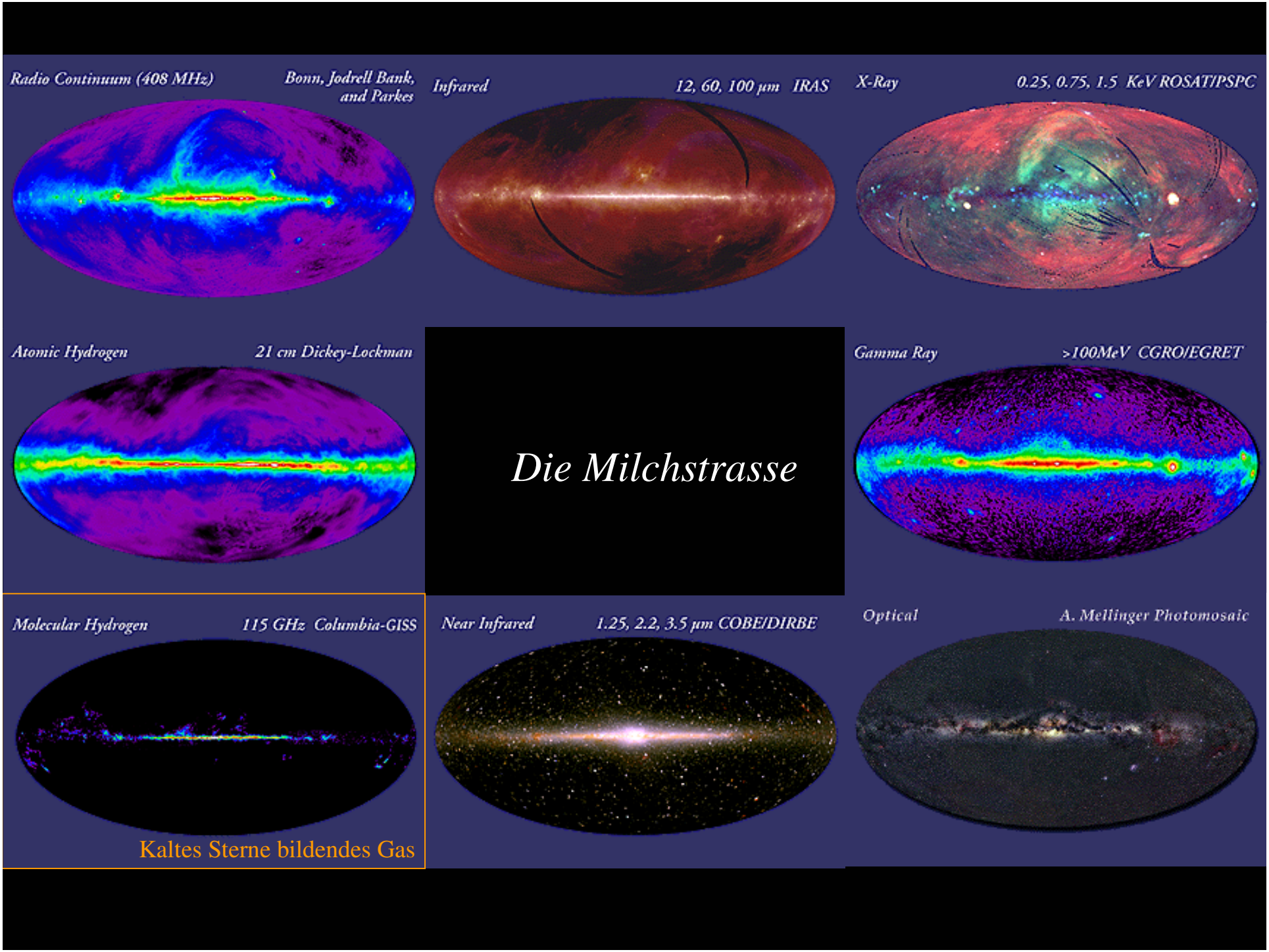
Die Milchstrasse

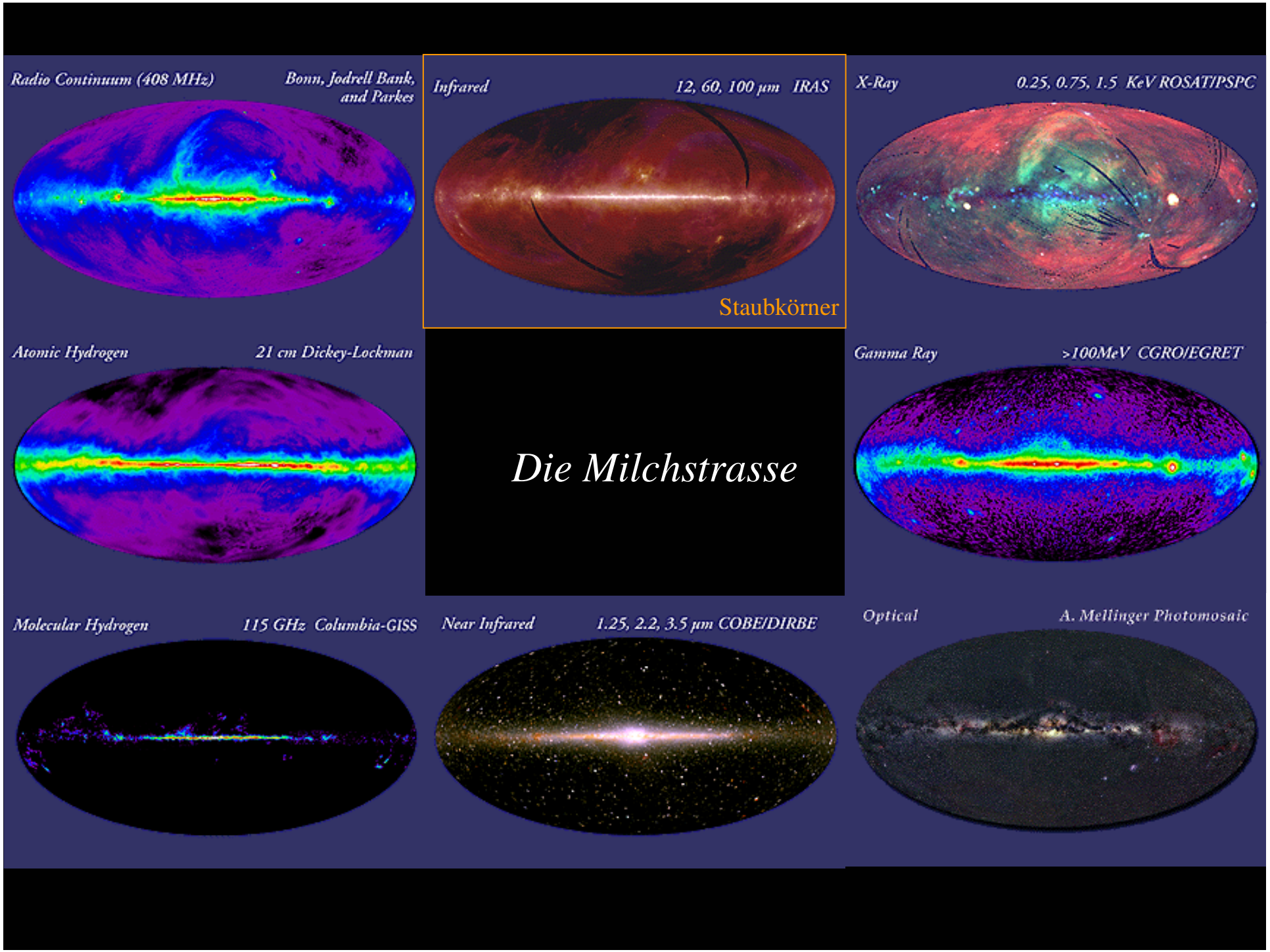


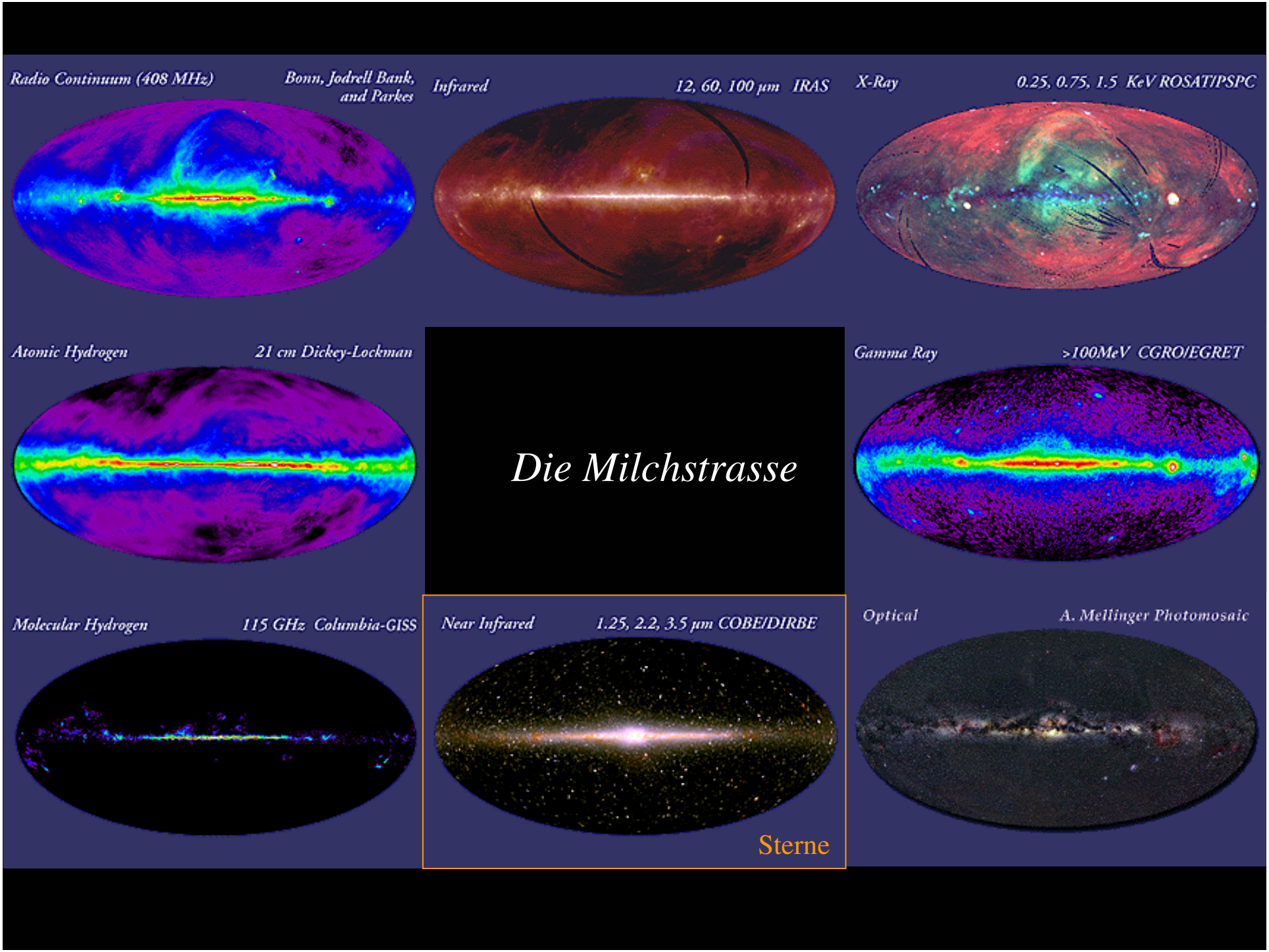

Radio Continuum (408 MHz)
Bonn, Jodrell Bank, and Parkes
Infrared
12, 60, 100 μm IRAS
X-Ray
0.25, 0.75, 1.5 KeV ROSAT/PSPC
Atomic Hydrogen
21 cm Dickey-Lockman
Die Milchstrasse
Gamma Ray
>100MeV CGRO/EGRET
Molecular Hydrogen
115 GHz Columbia-GISS
Near Infrared
1.25, 2.2, 3.5 μm COBE/DIRBE
Optical
A. Mellinger Photomosaic

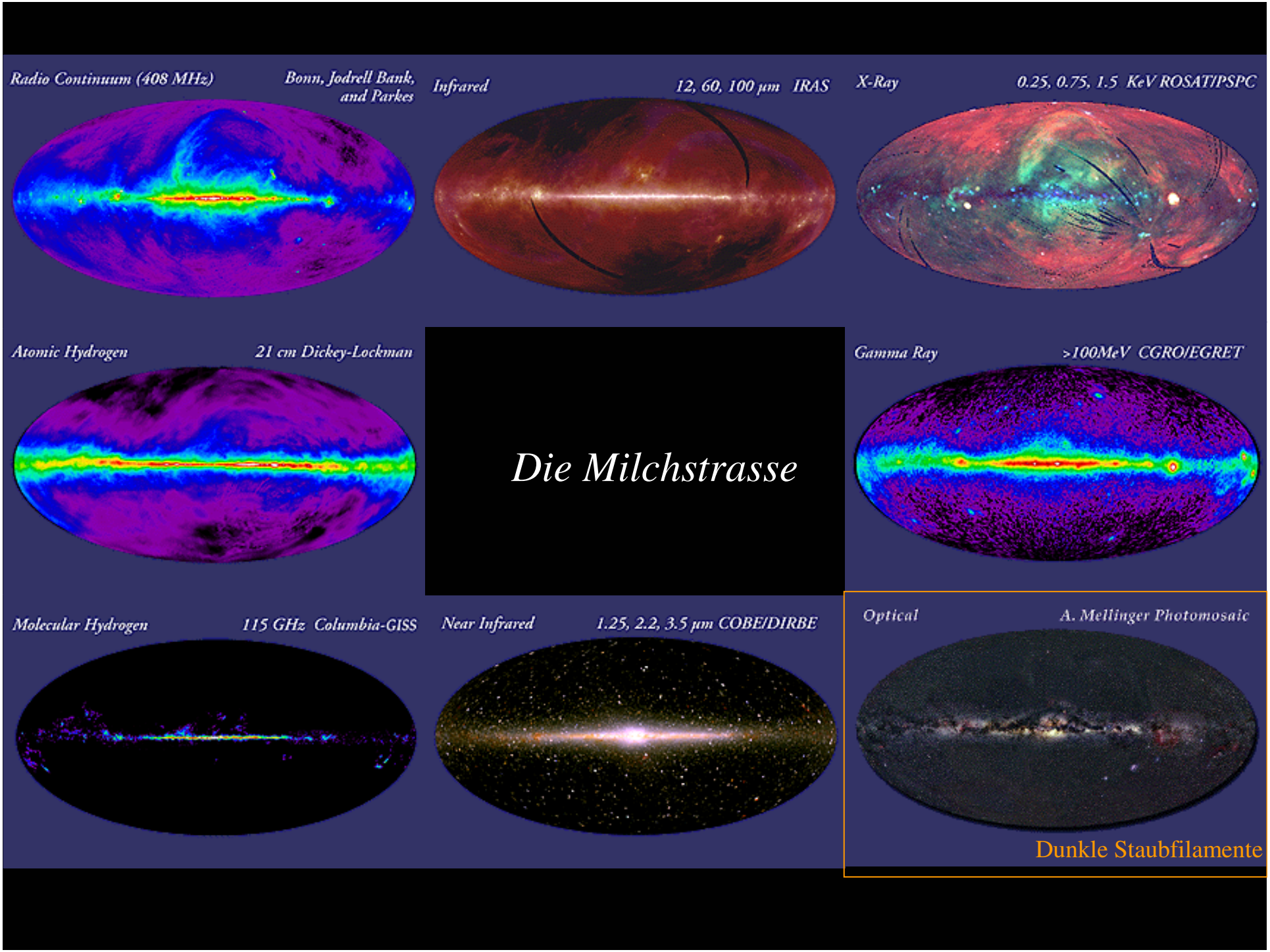

Radio Continuum (408 MHz)
Bonn, Jodrell Bank, and Parkes
Relativistische Elektronen
Infrared
12, 60, 100 μm IRAS
X-Ray
0.25, 0.75, 1.5 KeV ROSAT/PSPC
Atomic Hydrogen
21 cm Dickey-Lockman
Die Milchstrasse
Gamma Ray
>100MeV CGRO/EGRET
Molecular Hydrogen
115 GHz Columbia-GISS
Near Infrared
1.25, 2.2, 3.5 μm COBE/DIRBE
Optical
A. Mellinger Photomosaic

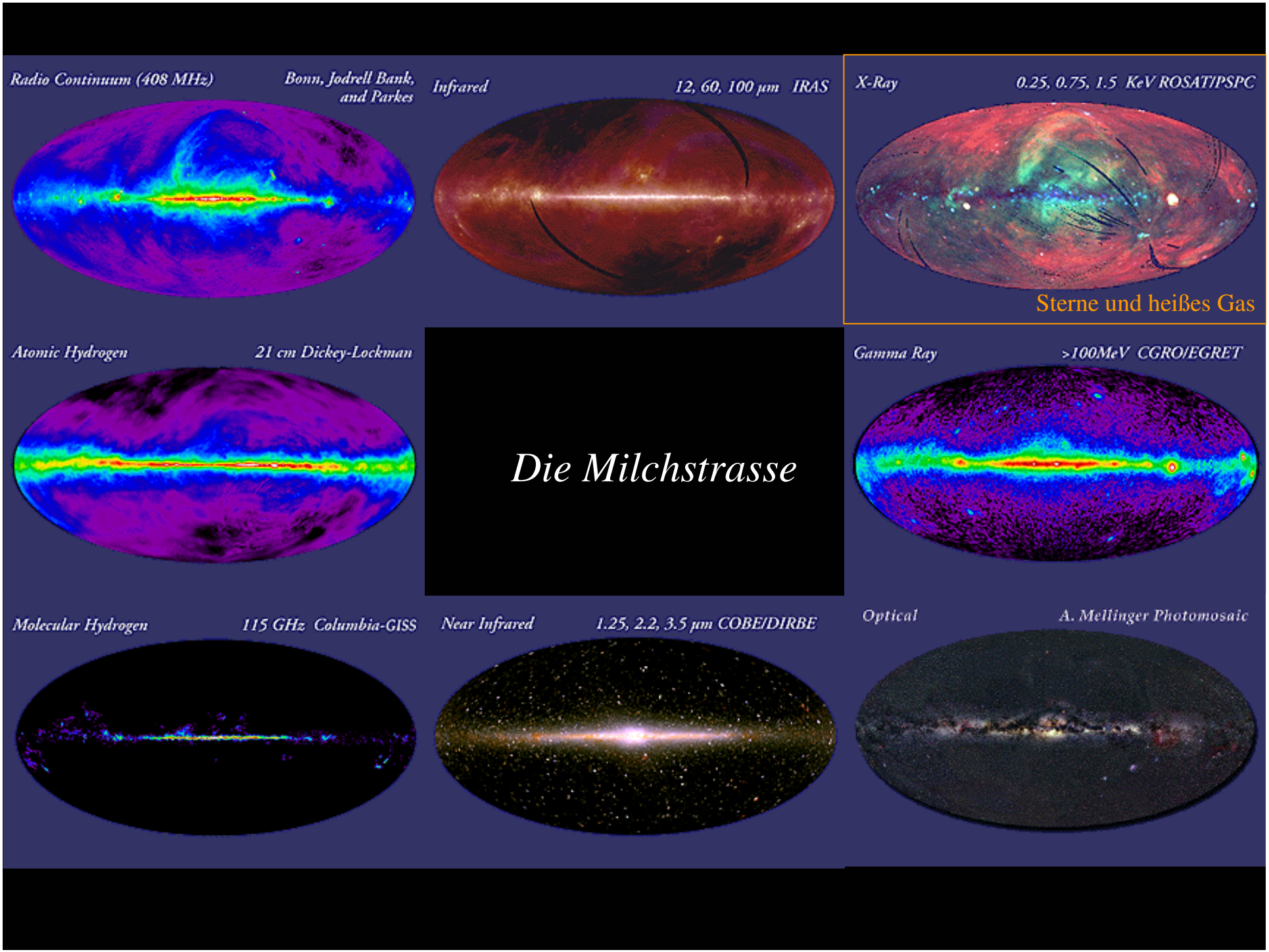

Radio Continuum (408 MHz)
Bonn, Jodrell Bank, and Parkes
Infrared
12, 60, 100 μm IRAS
X-Ray
0.25, 0.75, 1.5 KeV ROSAT/PSPC
Atomic Hydrogen
21 cm Dickey-Lockman
Neutrales Gas
Die Milchstrasse
Gamma Ray
>100MeV CGRO/EGRET
Molecular Hydrogen
115 GHz Columbia-GISS
Near Infrared
1.25, 2.2, 3.5 μm COBE/DIRBE
Optical
A. Mellinger Photomosaic

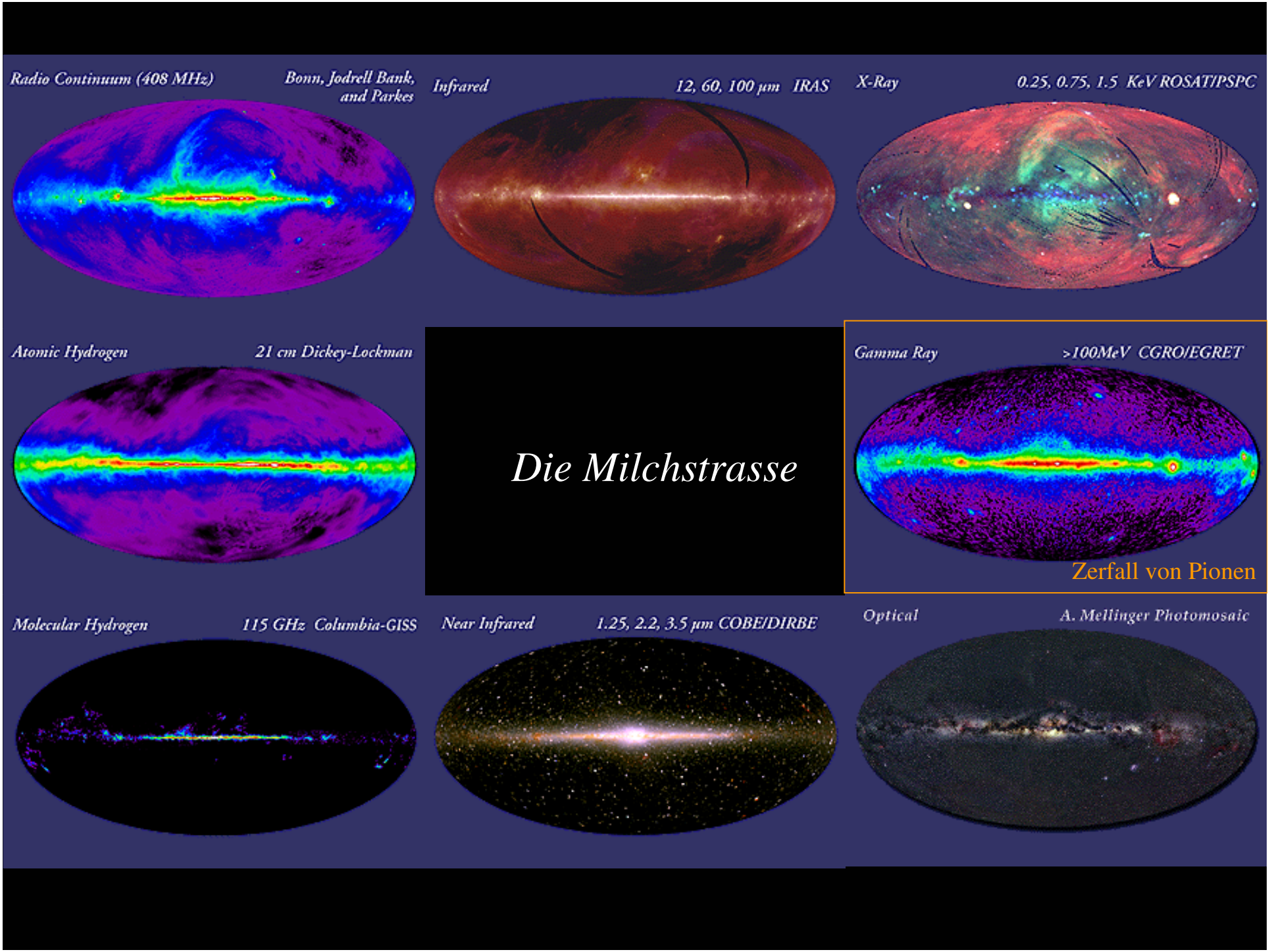

Radio Continuum (408 MHz)
Bonn, Jodrell Bank, and Parkes
Infrared
12, 60, 100 μm IRAS
X-Ray
0.25, 0.75, 1.5 KeV ROSAT/PSPC
Atomic Hydrogen
21 cm Dickey-Lockman
Die Milchstrasse
Gamma Ray
>100MeV CGRO/EGRET
Molecular Hydrogen
115 GHz Columbia-GISS
Kaltes Sterne bildendes Gas
Near Infrared
1.25, 2.2, 3.5 μm COBE/DIRBE
Optical
A. Mellinger Photomosaic


Radio Continuum (408 MHz)
Bonn, Jodrell Bank, and Parkes
Infrared
12, 60, 100 μm IRAS
Staubkörner
X-Ray
0.25, 0.75, 1.5 KeV ROSAT/PSPC
Atomic Hydrogen
21 cm Dickey-Lockman
Die Milchstrasse
Gamma Ray
>100MeV CGRO/EGRET
Molecular Hydrogen
115 GHz Columbia-GISS
Near Infrared
1.25, 2.2, 3.5 μm COBE/DIRBE
Optical
A. Mellinger Photomosaic

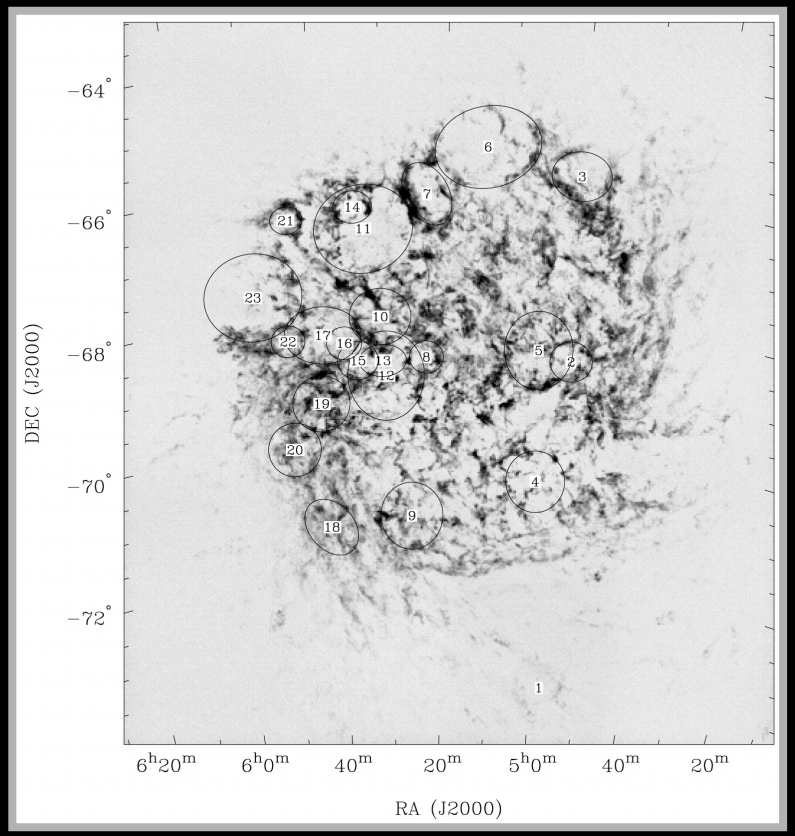

Radio Continuum (408 MHz)
Bonn, Jodrell Bank, and Parkes
Infrared
12, 60, 100 μm IRAS
X-Ray
0.25, 0.75, 1.5 KeV ROSAT/PSPC
Atomic Hydrogen
21 cm Dickey-Lockman
Die Milchstrasse
Gamma Ray
>100MeV CGRO/EGRET
Molecular Hydrogen
115 GHz Columbia-GISS
Near Infrared
1.25, 2.2, 3.5 μm COBE/DIRBE
Sterne
Optical
A. Mellinger Photomosaic


Radio Continuum (408 MHz)
Bonn, Jodrell Bank, and Parkes
Infrared
12, 60, 100 μm IRAS
X-Ray
0.25, 0.75, 1.5 KeV ROSAT/PSPC
Atomic Hydrogen
21 cm Dickey-Lockman
Die Milchstrasse
Gamma Ray
>100MeV CGRO/EGRET
Molecular Hydrogen
115 GHz Columbia-GISS
Near Infrared
1.25, 2.2, 3.5 μm COBE/DIRBE
Optical
A. Mellinger Photomosaic
Dunkle Staubfilamente


Radio Continuum (408 MHz)
Bonn, Jodrell Bank, and Parkes
Infrared
12, 60, 100 μm IRAS
X-Ray
0.25, 0.75, 1.5 KeV ROSAT/PSPC
Sterne und heißes Gas
Atomic Hydrogen
21 cm Dickey-Lockman
Die Milchstrasse
Gamma Ray
>100MeV CGRO/EGRET
Molecular Hydrogen
115 GHz Columbia-GISS
Near Infrared
1.25, 2.2, 3.5 μm COBE/DIRBE
Optical
A. Mellinger Photomosaic

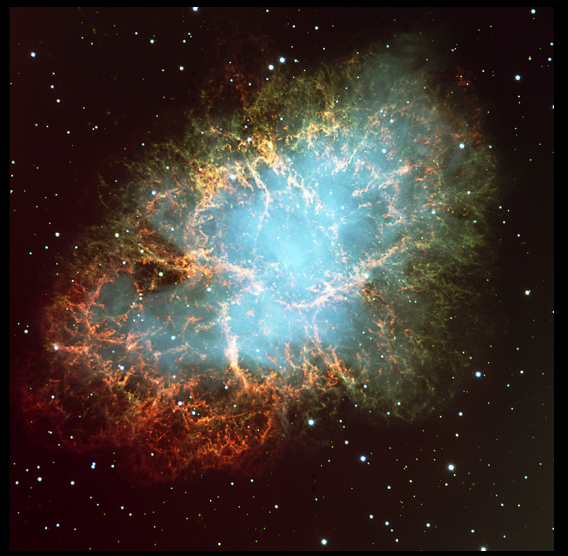

Radio Continuum (408 MHz)
Bonn, Jodrell Bank, and Parkes
Infrared
12, 60, 100 μm IRAS
X-Ray
0.25, 0.75, 1.5 KeV ROSAT/PSPC
Atomic Hydrogen
21 cm Dickey-Lockman
Die Milchstrasse
Gamma Ray
>100MeV CGRO/EGRET
Zerfall von Pionen
Molecular Hydrogen
115 GHz Columbia-GISS
Near Infrared
1.25, 2.2, 3.5 μm COBE/DIRBE
Optical
A. Mellinger Photomosaic

Das Mehrphasen-ISM



(Kim et al. 1998, 1999)

Supernova

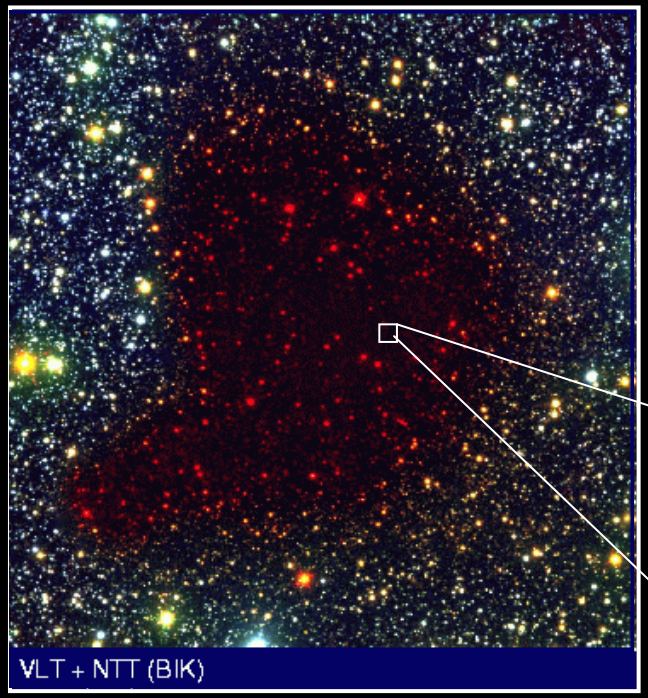


Planetarischer Nebel

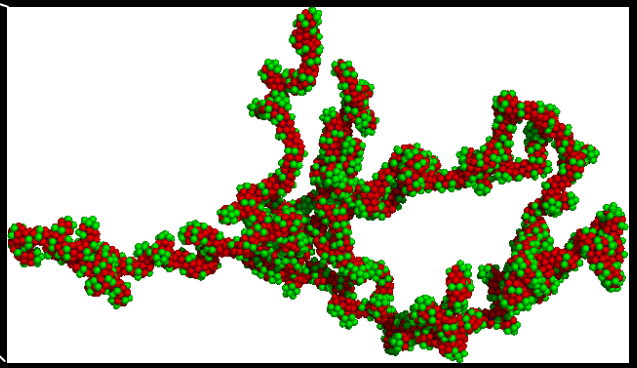
Die Schlange (Barnard 72)

Eine Reihe dunkler Gasbänder

Die Staubwolke Barnard 68

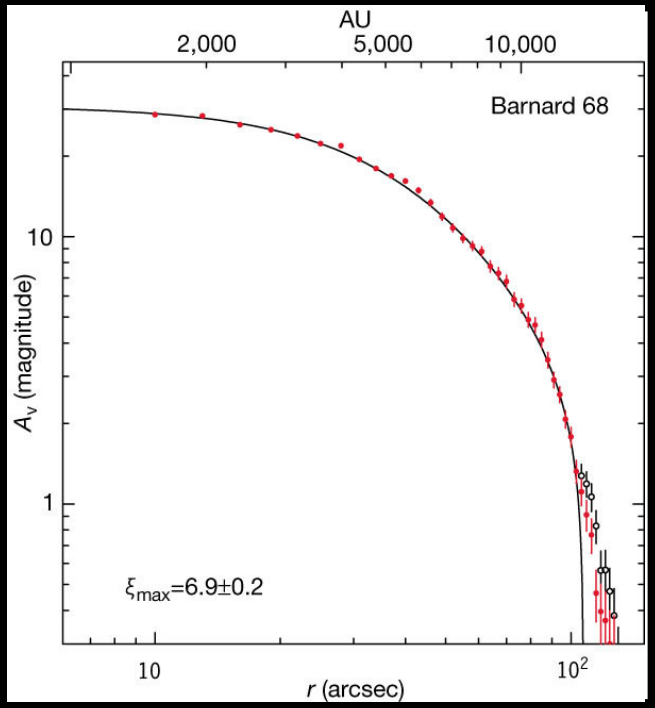


(Alves et al. 2001)



C, Si, O

Die Staubwolke Barnard 68



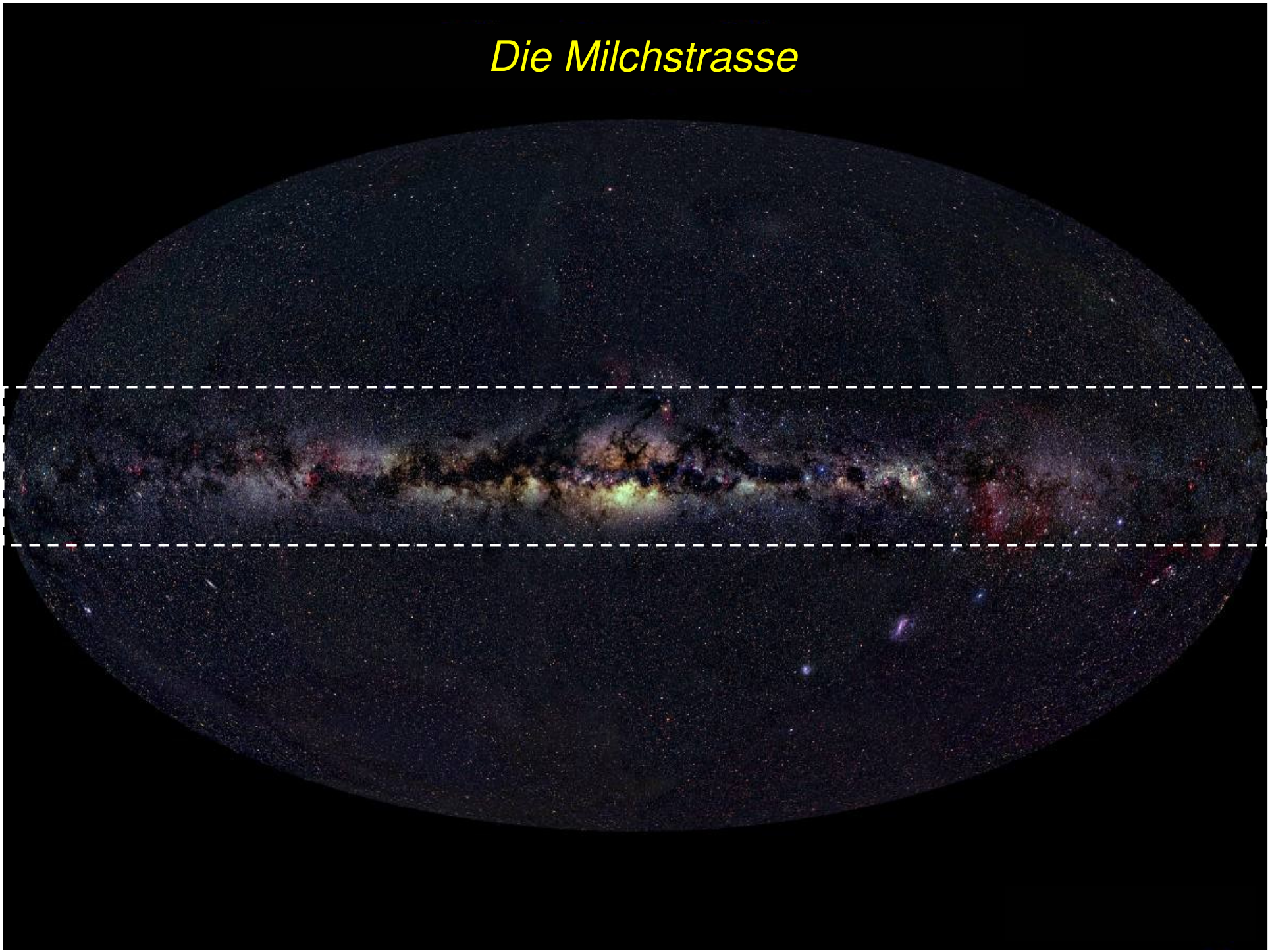
(Alves et al. 2001)

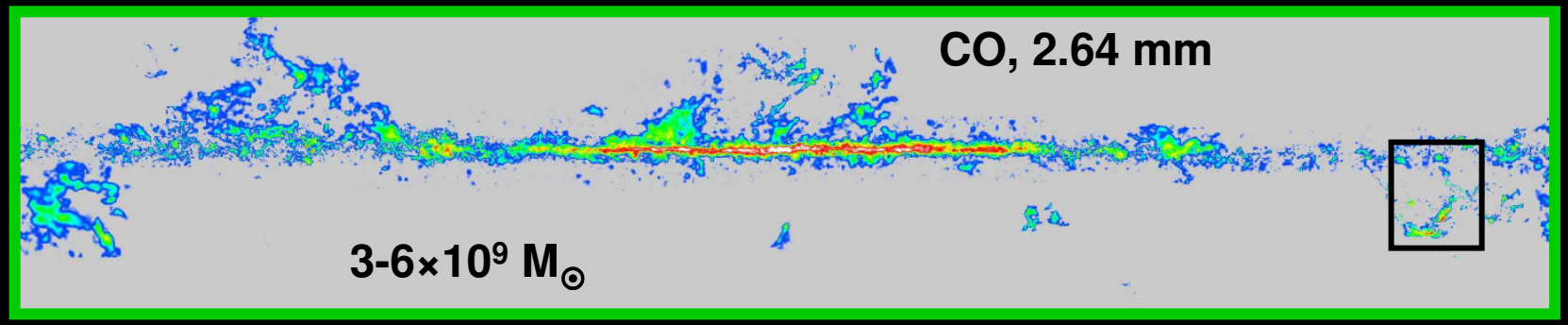
Entfernung:	125 pc
Radius:	12500 AU
Masse:	2.1 $M_\odot$
Dichte:	$1.5 \cdot 10^{-19}\ g\ cm^{-3}$
Temperatur:	16 K

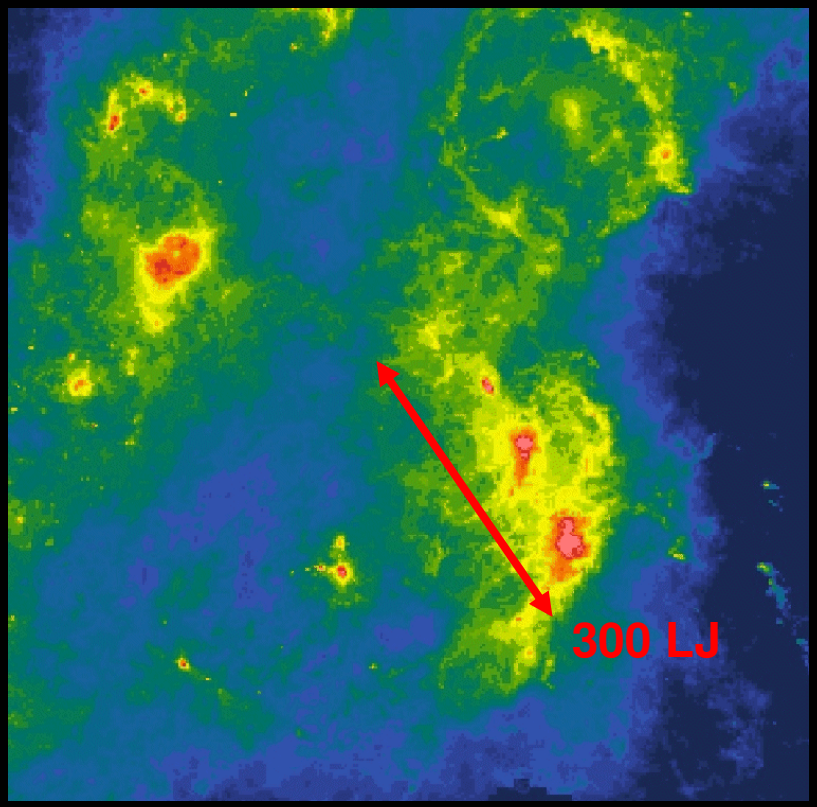
Jeansmasse: $$M_{Jeans} = \left(\frac{\pi}{G}\right)^{3/2} c_s^{\,3}\ \rho^{-1/2} \approx 0.65\ M_\odot$$

Freie Fallzeit: $$\tau_{ff} = \sqrt{\frac{3\pi}{32 G \rho}} \approx 1.7 \cdot 10^5\ Jahre$$

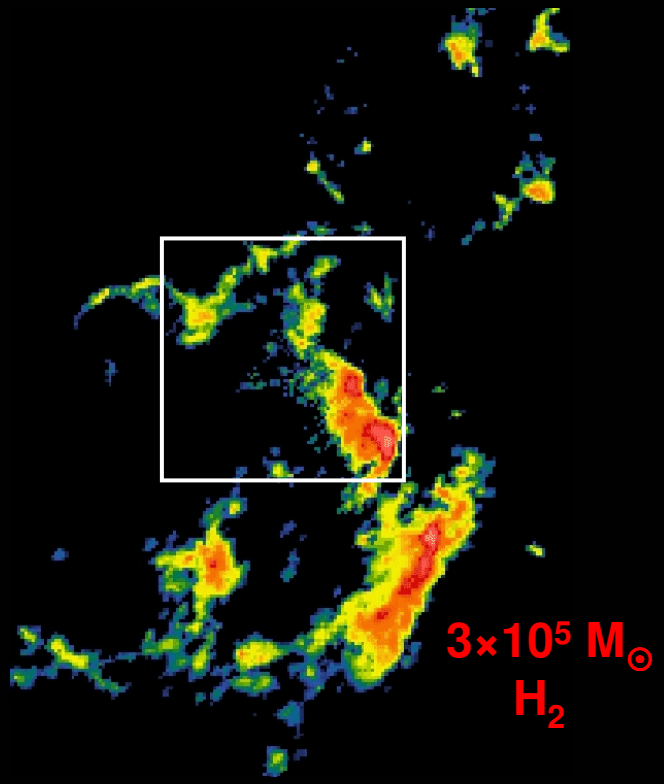
Die Milchstrasse





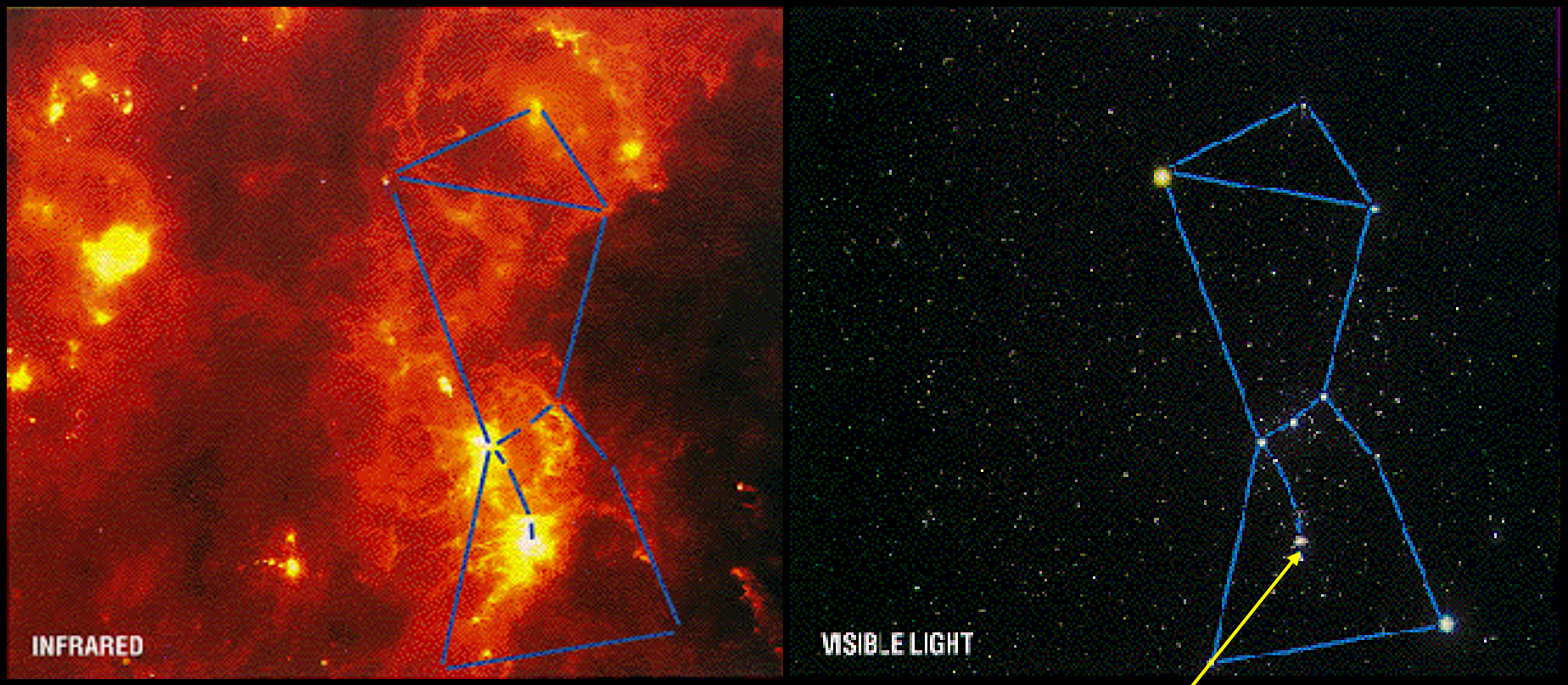


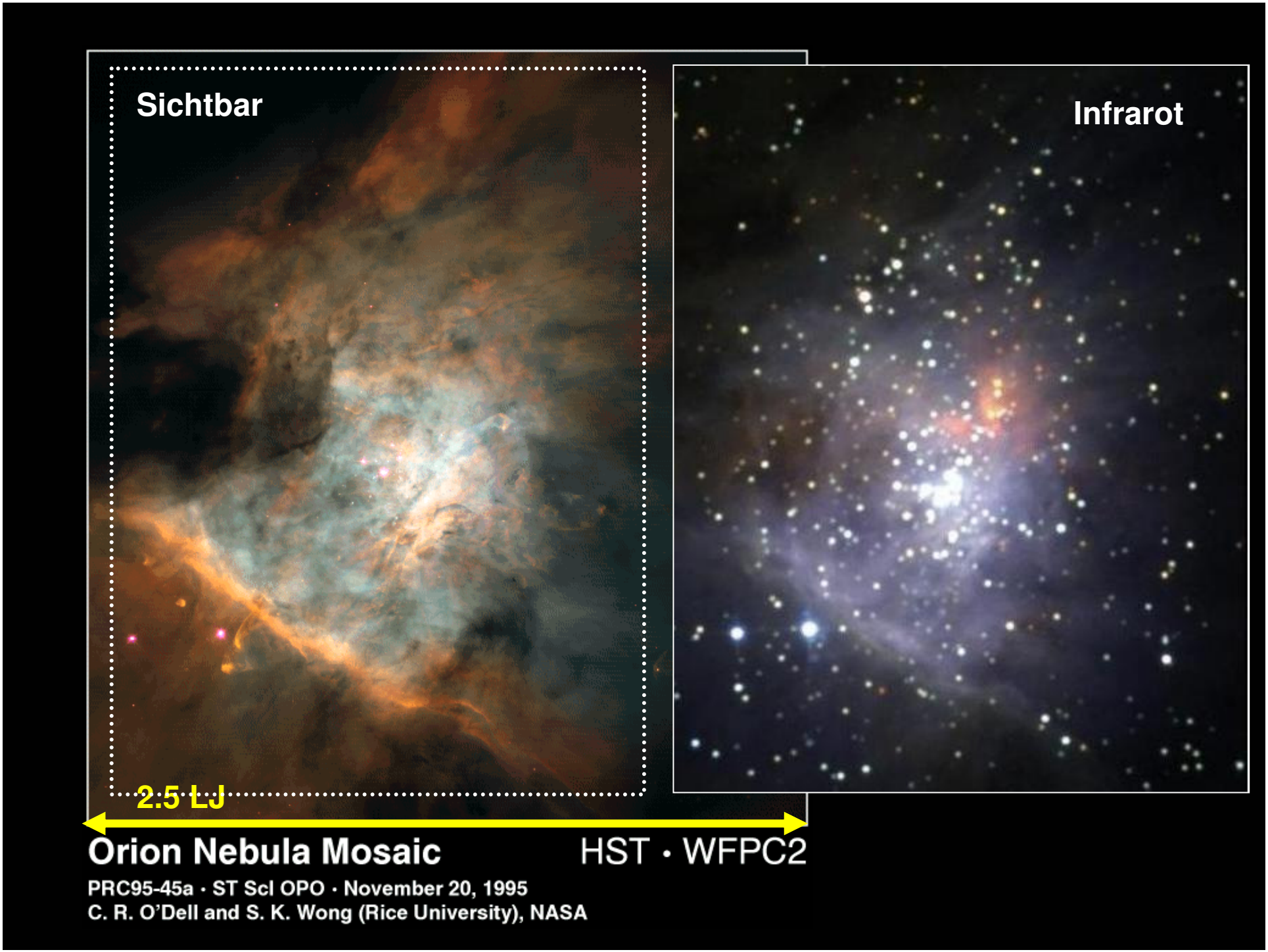
Infrarot



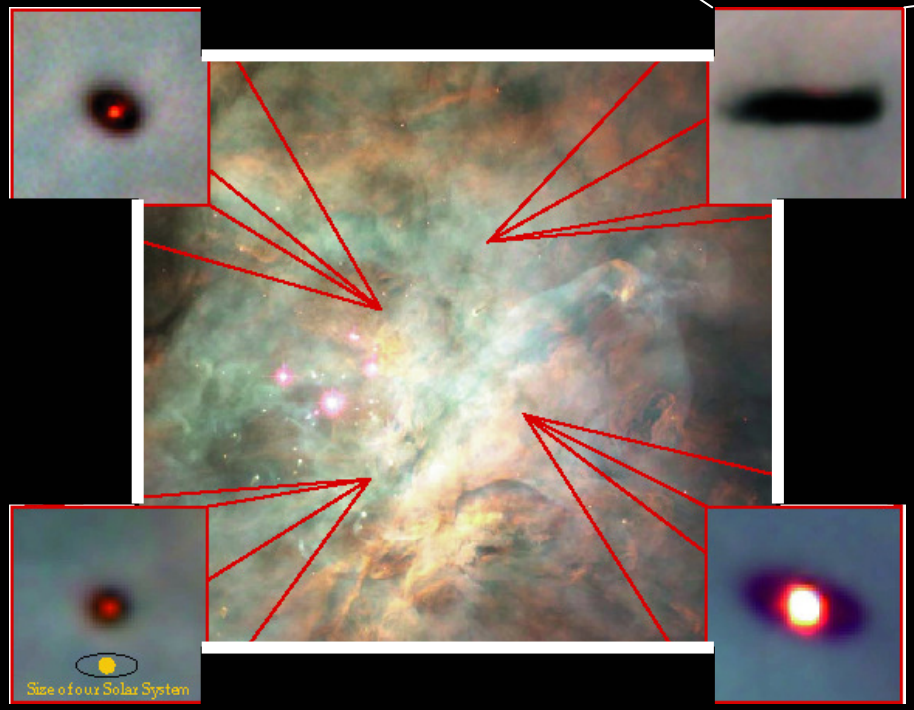
CO

Das Orion-Sternentstehungsgebiet




Sichtbar
Infrarot
2.5 LJ
Orion Nebula Mosaic
HST · WFPC2
PRC95-45a · ST ScI OPO · November 20, 1995
C. R. O'Dell and S. K. Wong (Rice University), NASA

Protostellare Scheibe

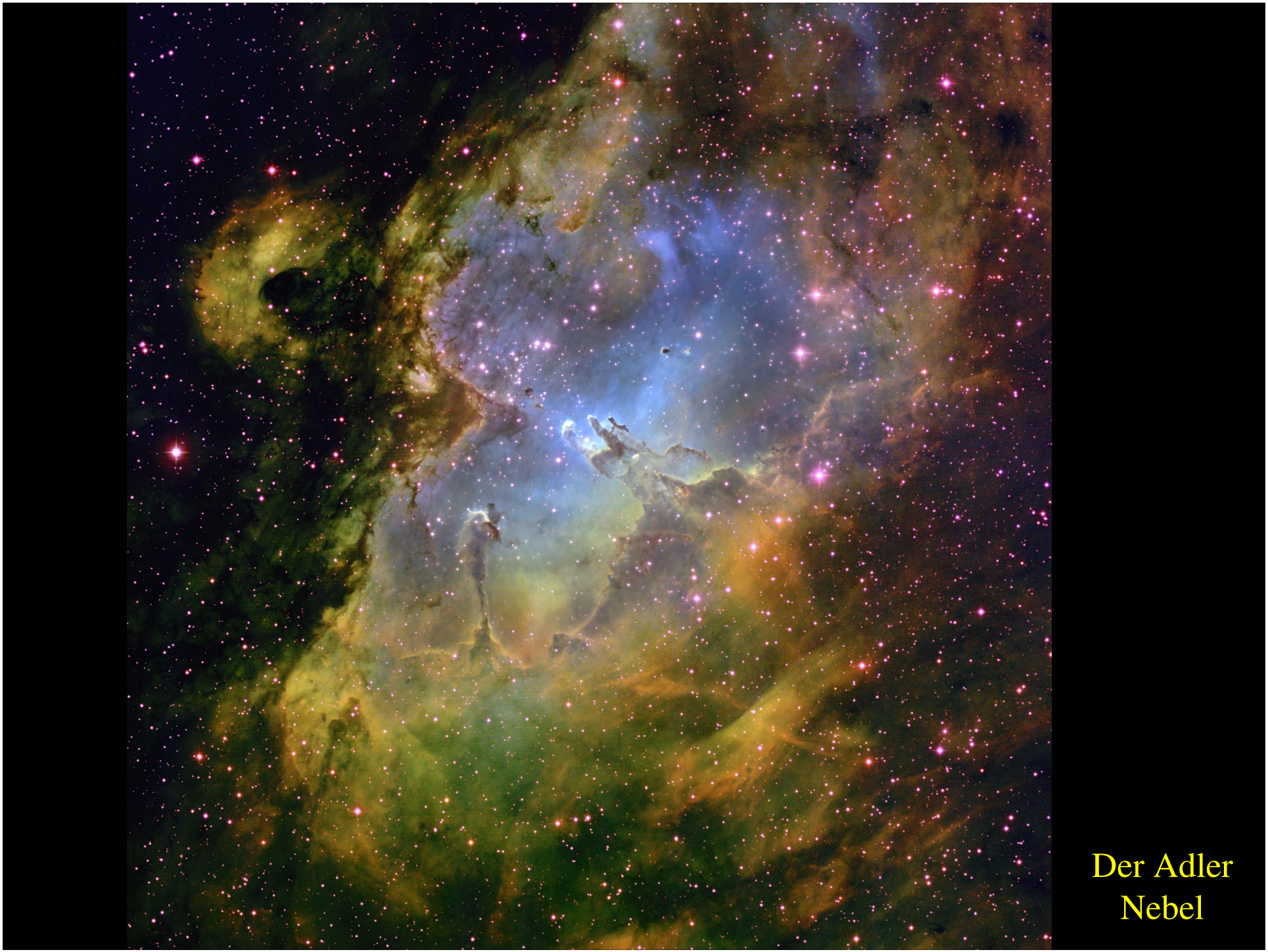


Alter:
Einige Millionen Jahre

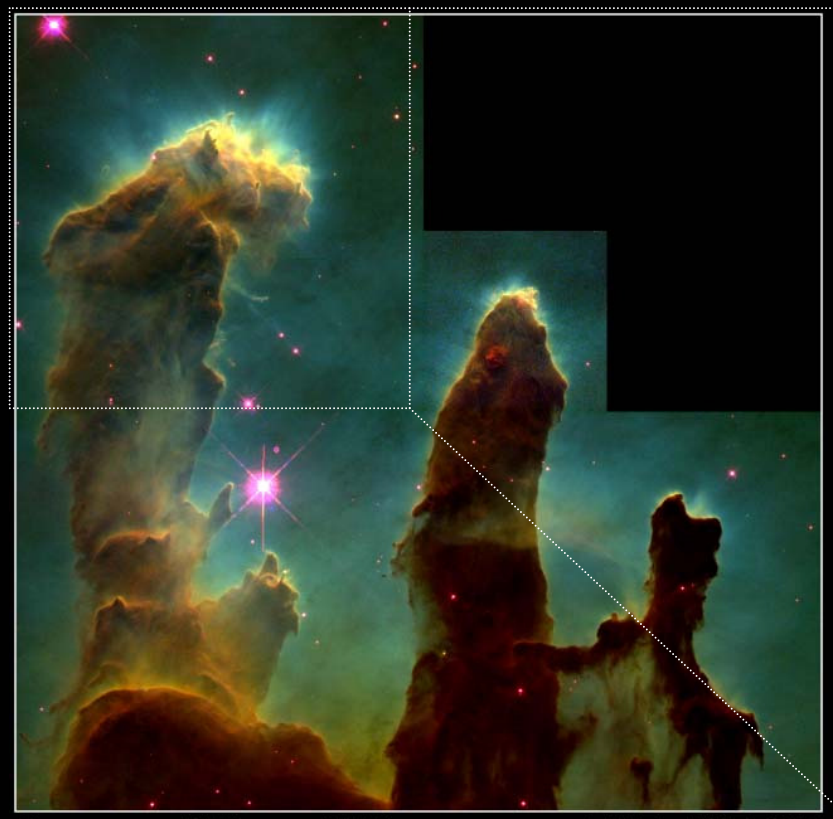
150 Objekte
R = 50 -1000 AU

M > 600 $M_{\oplus}$

Der Lagunen Nebel



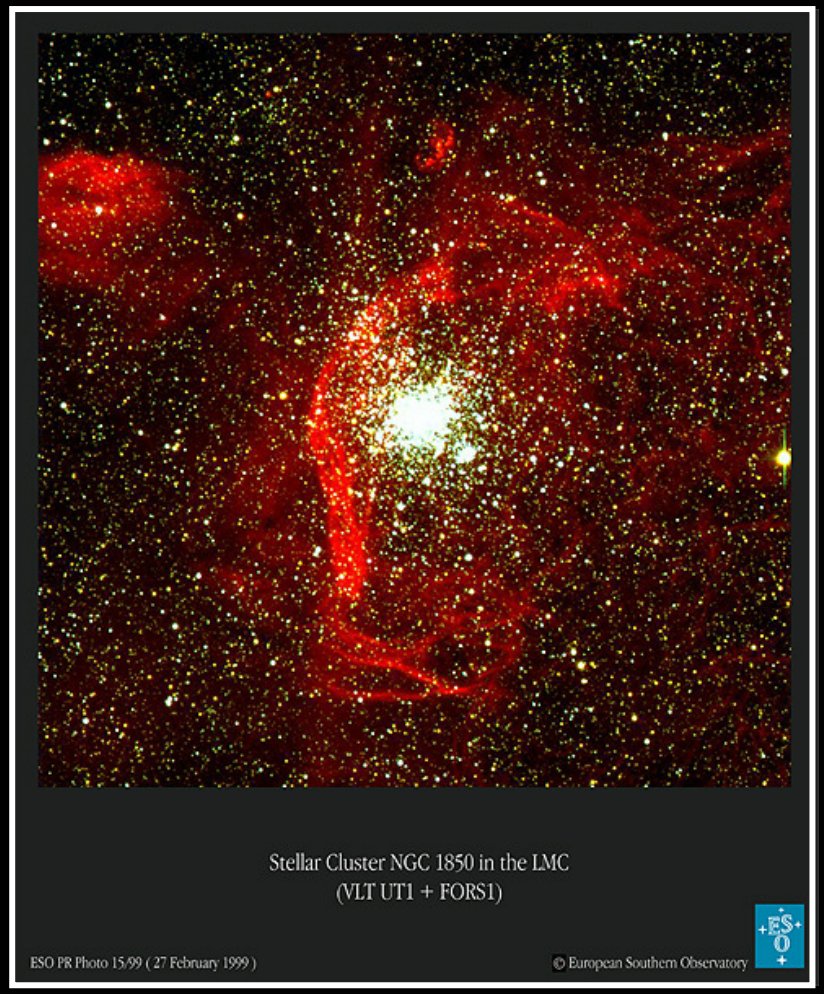
Der Adler
Nebel



Gaseous Pillars · M16 HST · WFPC2

Star-Birth Clouds · M16 HST · WFPC2

Der Pferdekopfnebel



Stellar Cluster NGC 1850 in the LMC
(VLT UT1 + FORS1)

ESO PR Photo 15/99 (27 February 1999)