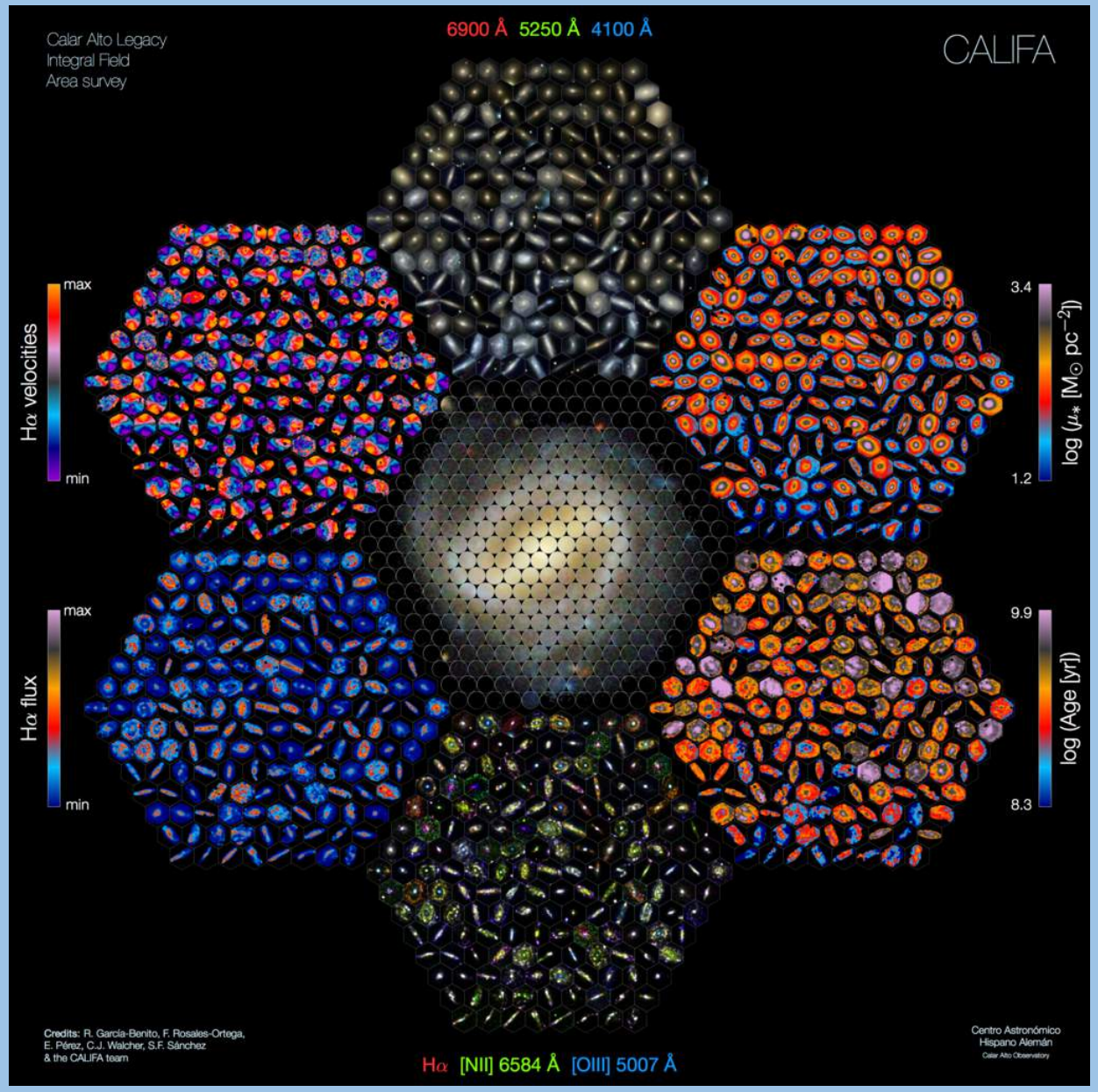
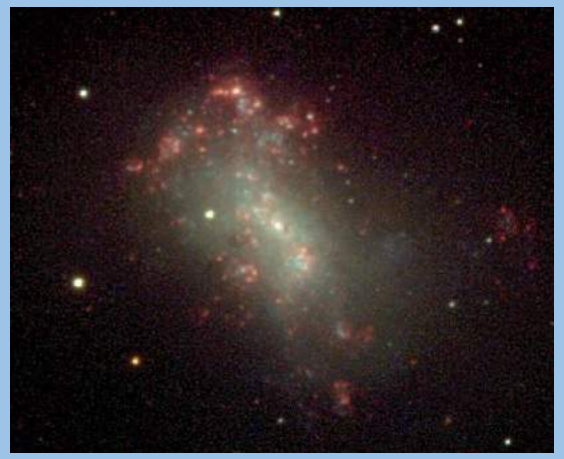
CALIFA: 3D Physik der Galaxien

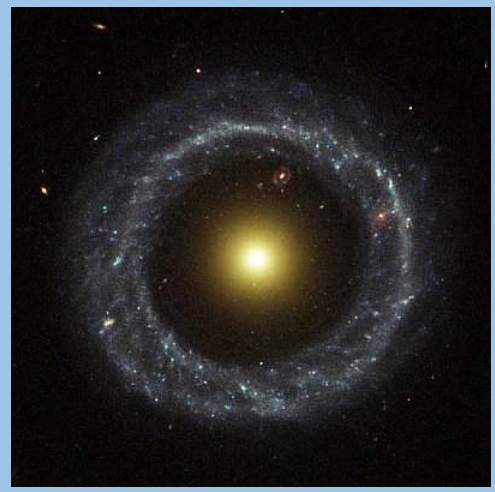


Bodo Ziegler

Institut für
Astrophysik
Universität Wien

Das Reich der Galaxien



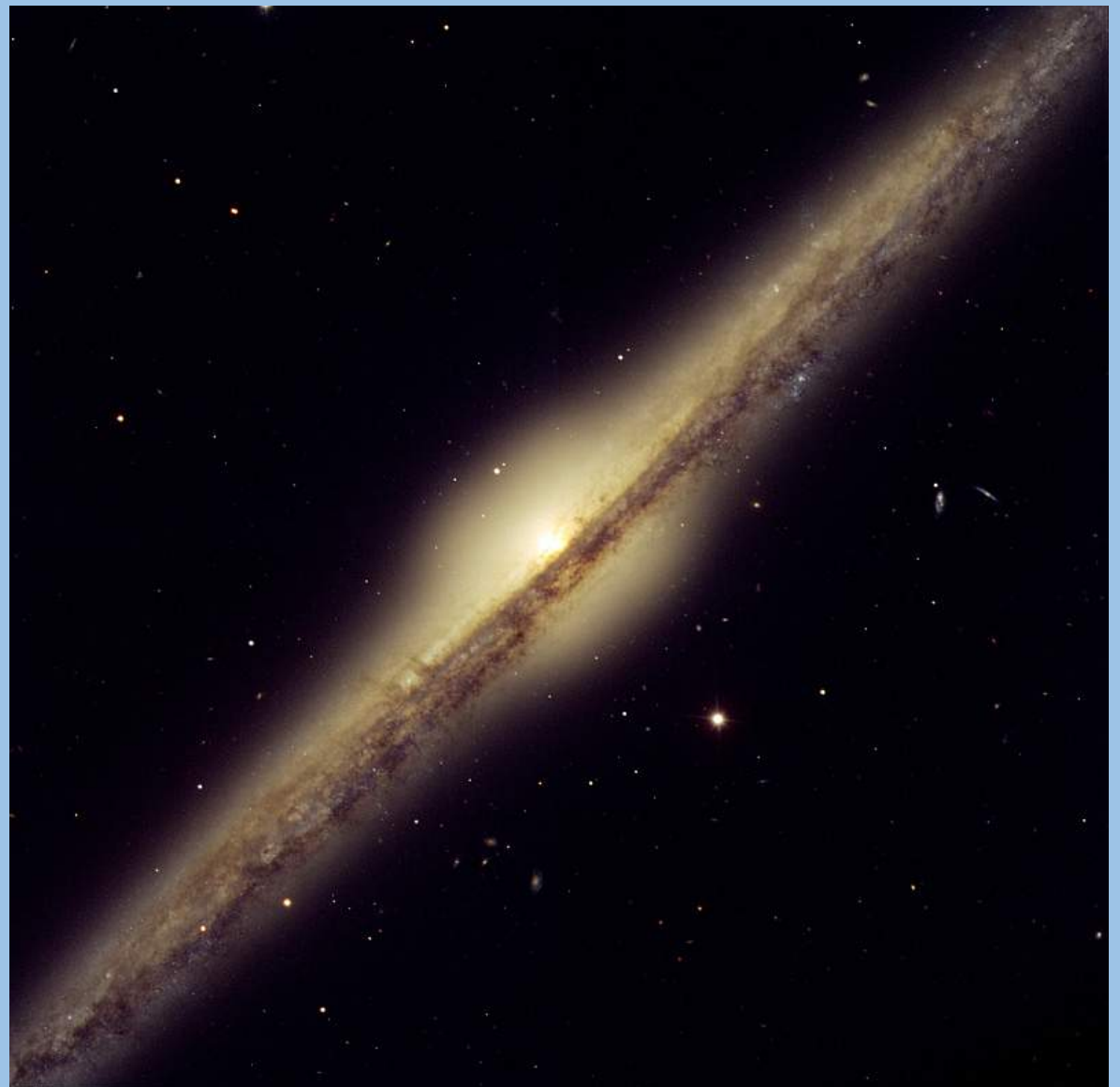


Spiralgalaxien

NGC
1231

FORS am
Very Large
Telesope
Europäische
Südsternwarte

Spiralgalaxien



NGC
4565

FORS am
Very Large
Telesope
Europäische
Südsternwarte

Balkenspiralgalaxien

NGC
1097

VIMOS am
Very Large
Telesope
Europäische
Südsternwarte

Elliptische Galaxien

M 87

Anglo-
Australisches
Observatorium

Linsenförmige Galaxien

Sombrero

FORS am VLT
ESO

Irreguläre Galaxien

Kleine Magellansche Wolke

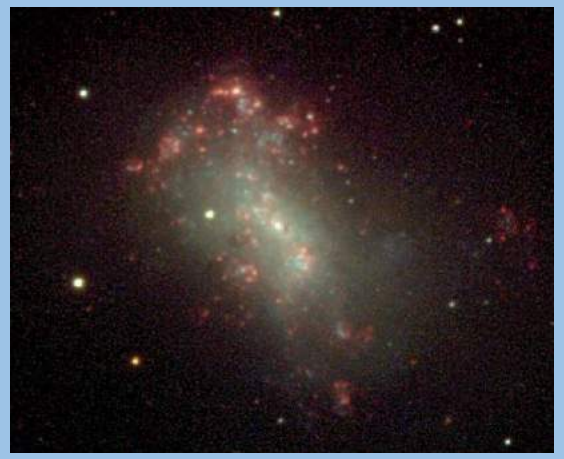
Wechselwirkende Galaxien

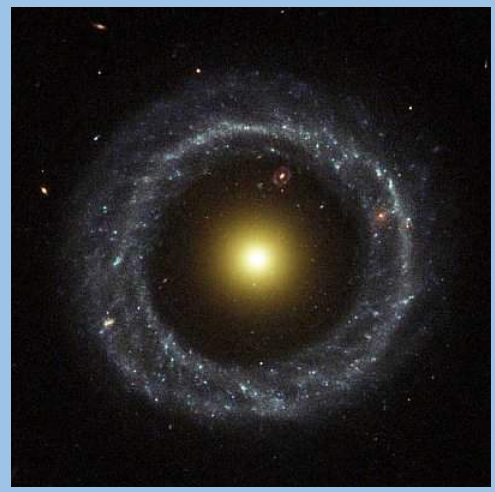
Pekuliare Galaxien

Hoag
Ringgalaxie

HST/NASA

Das Reich der Galaxien

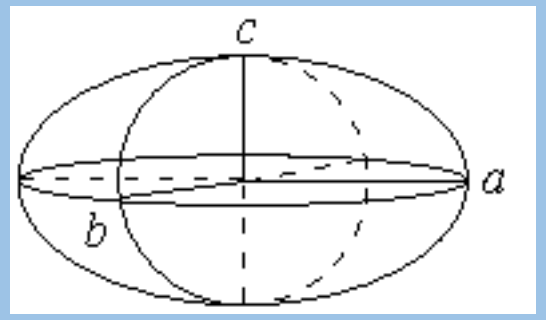


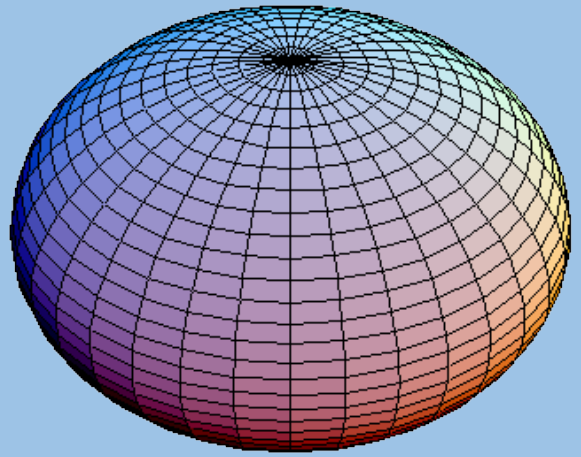


Physik der Galaxien

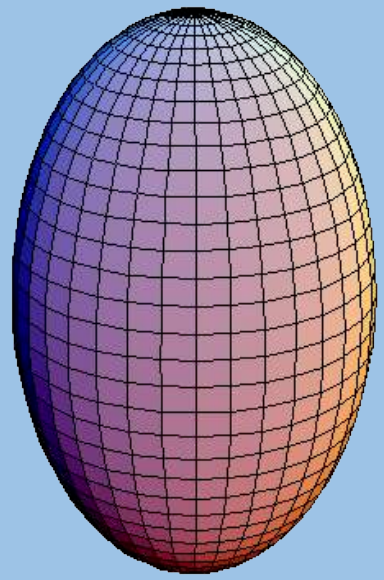
- Welche Masse besitzen Galaxien? (“wie schwer sind sie”?)
- Welche Komponenten/Strukturen gibt es?
- Wie bewegen sich die Sterne / das Gas? (Kinematik)
- Wie alt sind Galaxien? (Entstehen sie? Entwickeln sie sich?)
- Welche Sternpopulationen gibt es?
- Wieviel Sterne bilden sich neu in den verschiedenen Epochen?
- Was ist die Rolle der Schwarzen Löcher?
- etc usw

Three-dimensional shape



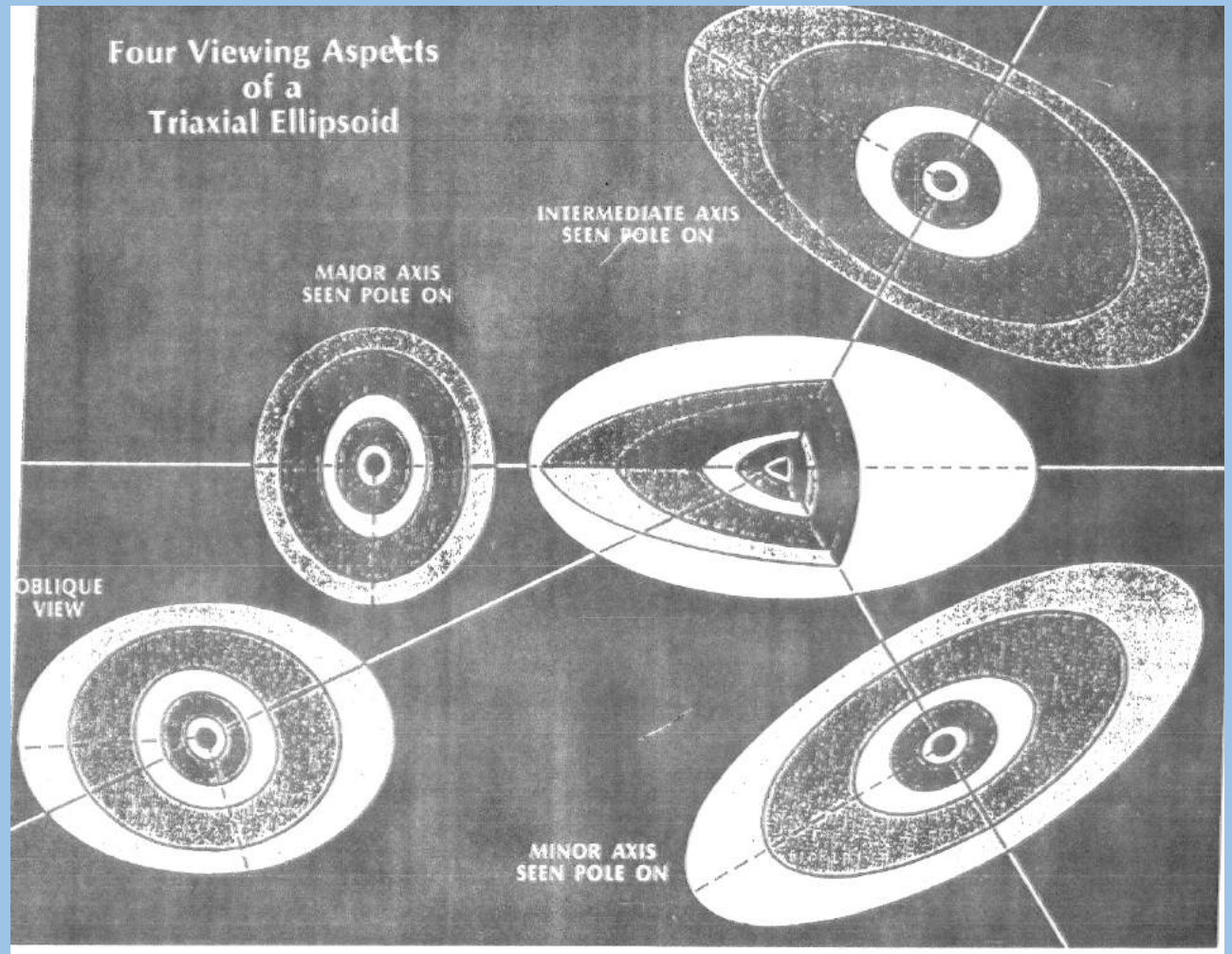


oblate



prolate

2D: Projektion auf 2 Ebenen



One of T. Williams' possible models of light distribution to explain the observed isophotes of NGC 596. In this case the

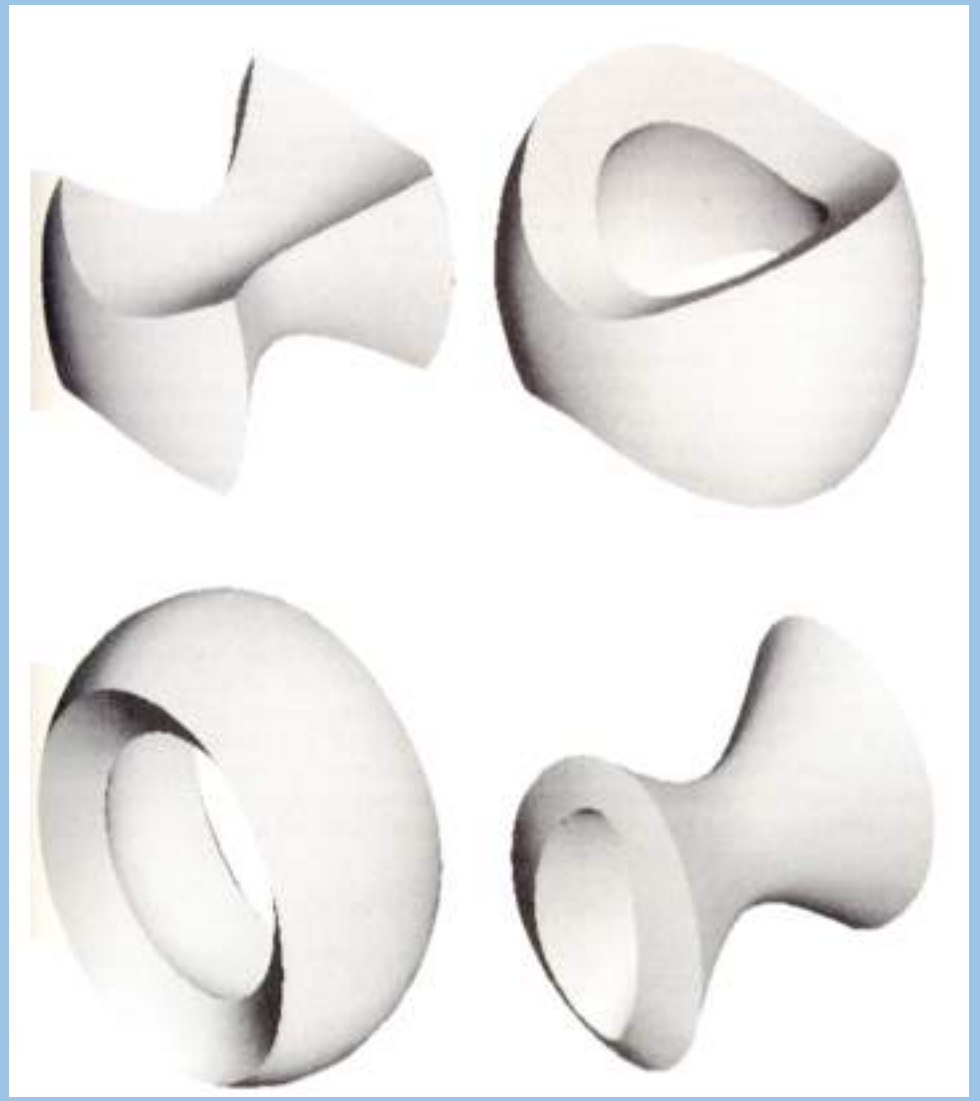
also exhibit the twisting phenomenon of their major axes at varying distances from the center.

Form hängt von Blickwinkel (Sichtlinie) ab

Kormendy

Stellare Orbits: Sternbahnen

box orbit



short-axis
tube orbit

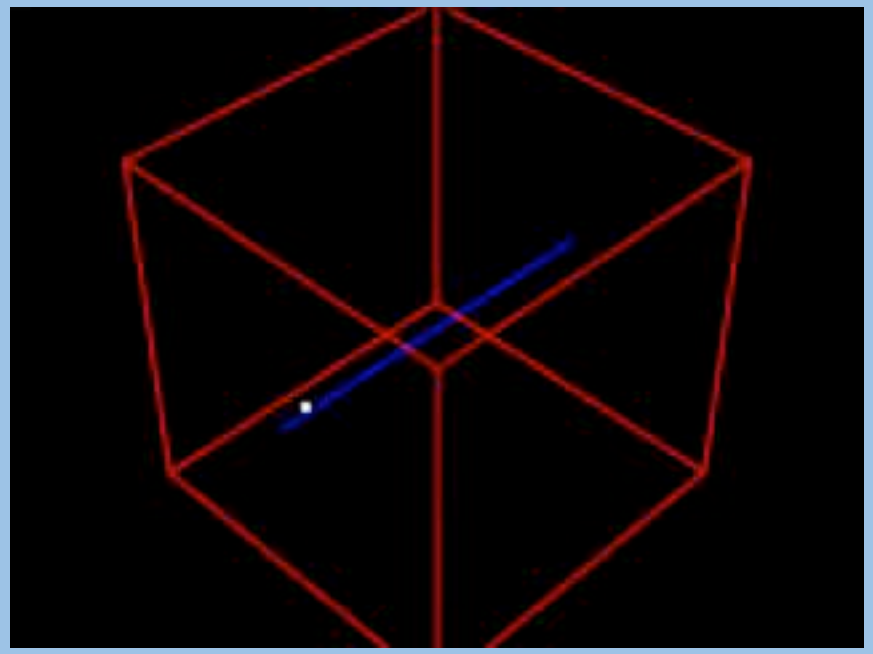
inner
long-axis
tube orbit

outer
long-axis
tube orbit

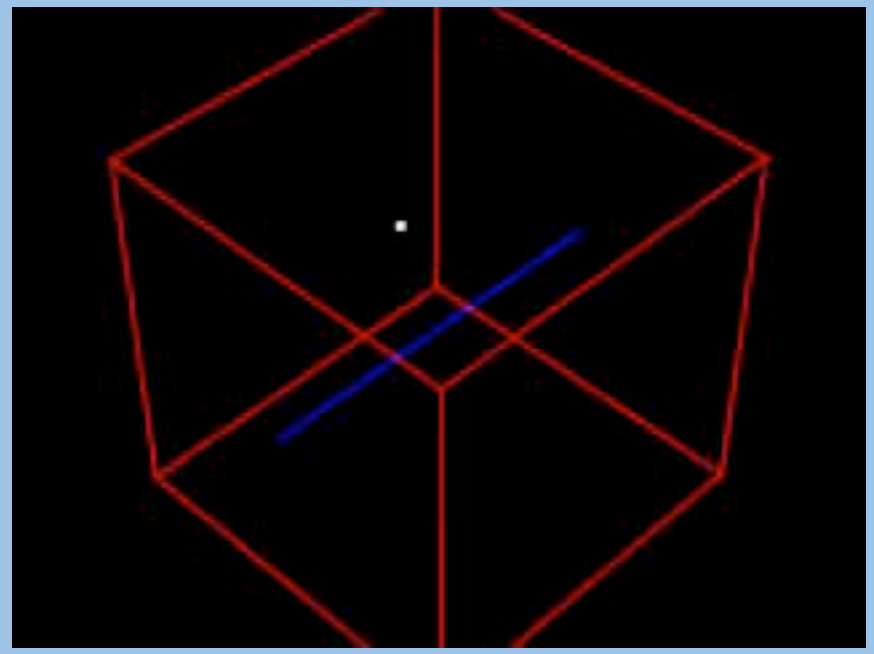
Binney & Tremaine

Stellare Orbits: Sternbahnen

box orbit



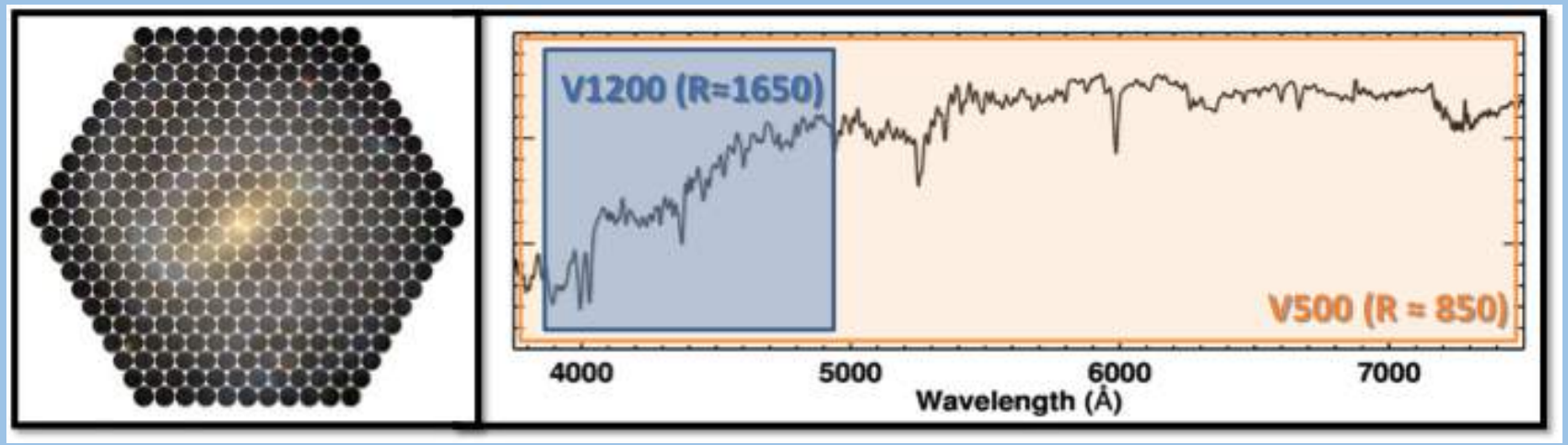
pretzel orbit



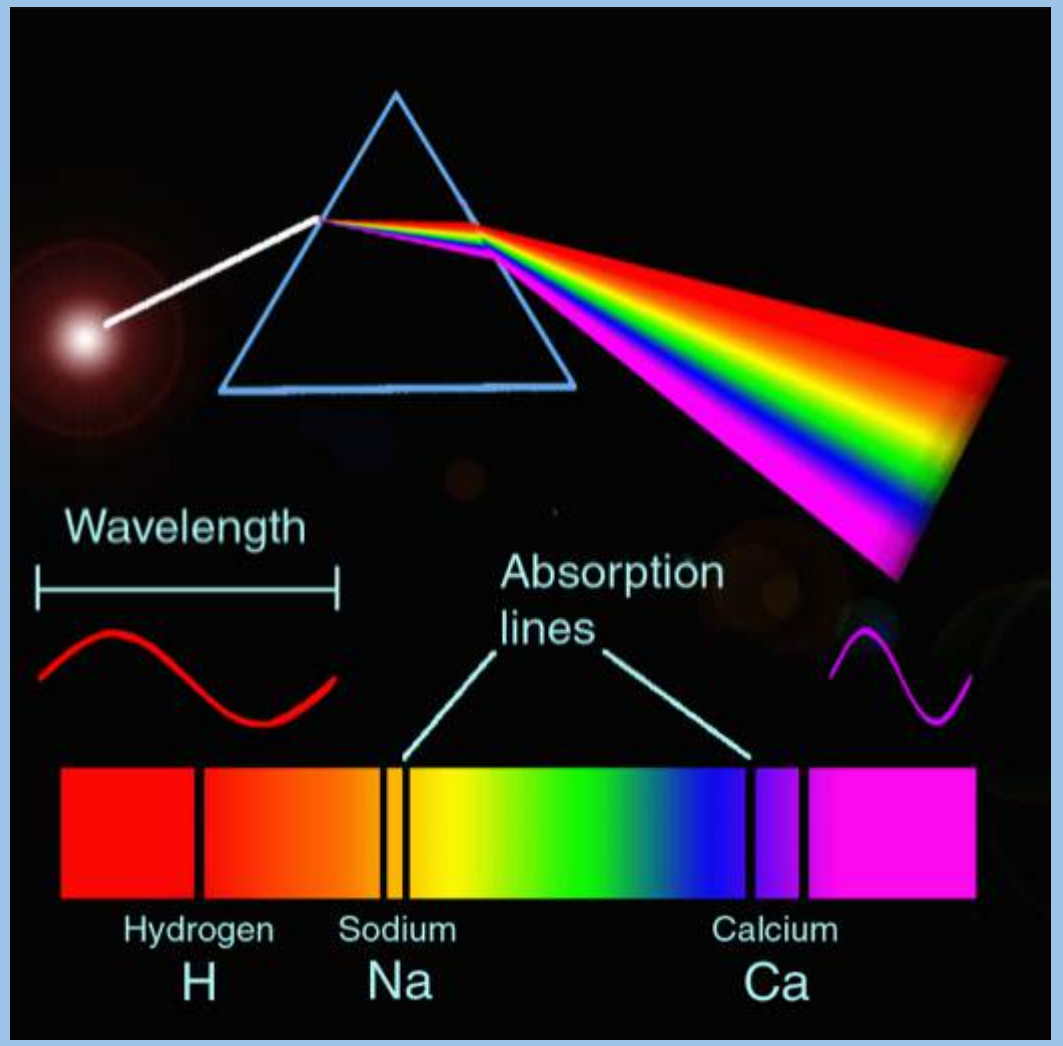
J. Barnes

Physik der Galaxien: CALIFA

Spektroskopie



Spektroskopie



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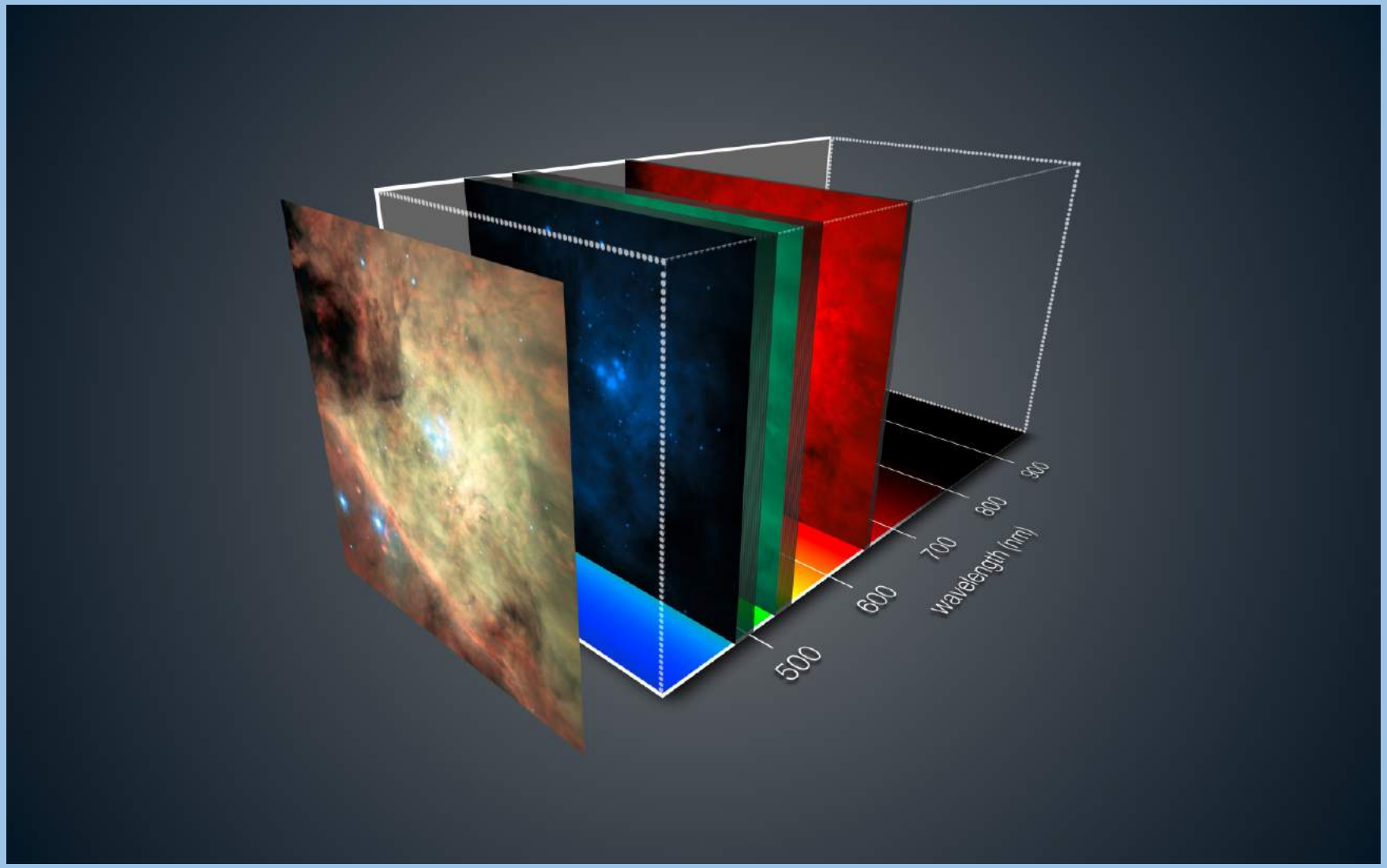
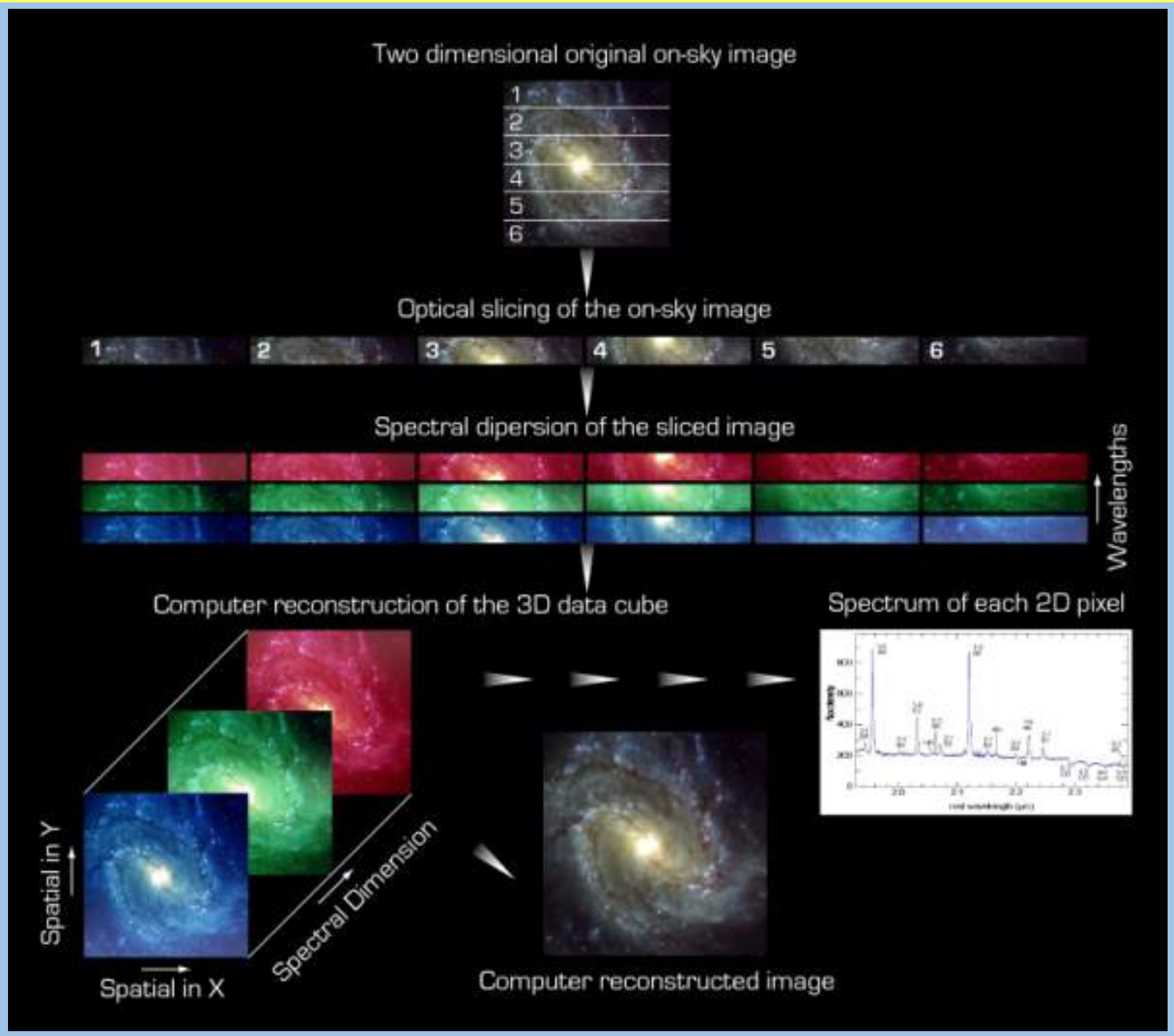
3D Spektroskopie



3D Spektroskopie

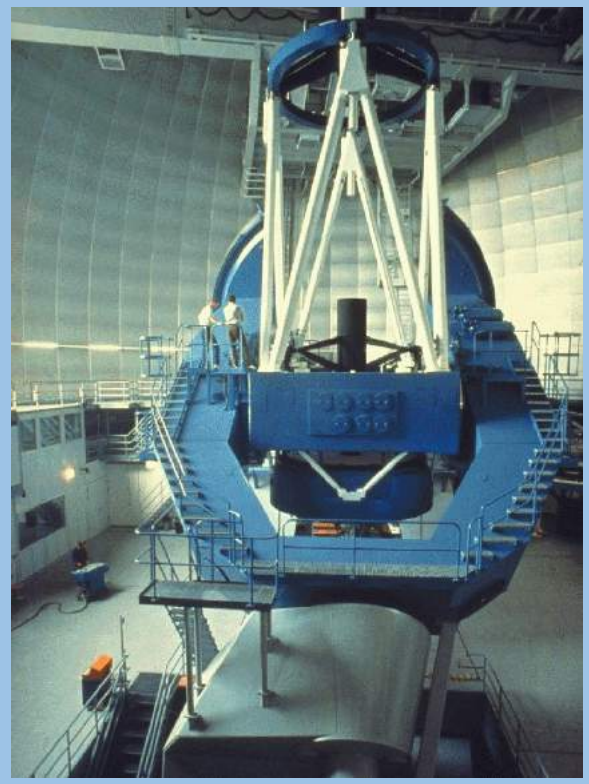


Gas: Emission

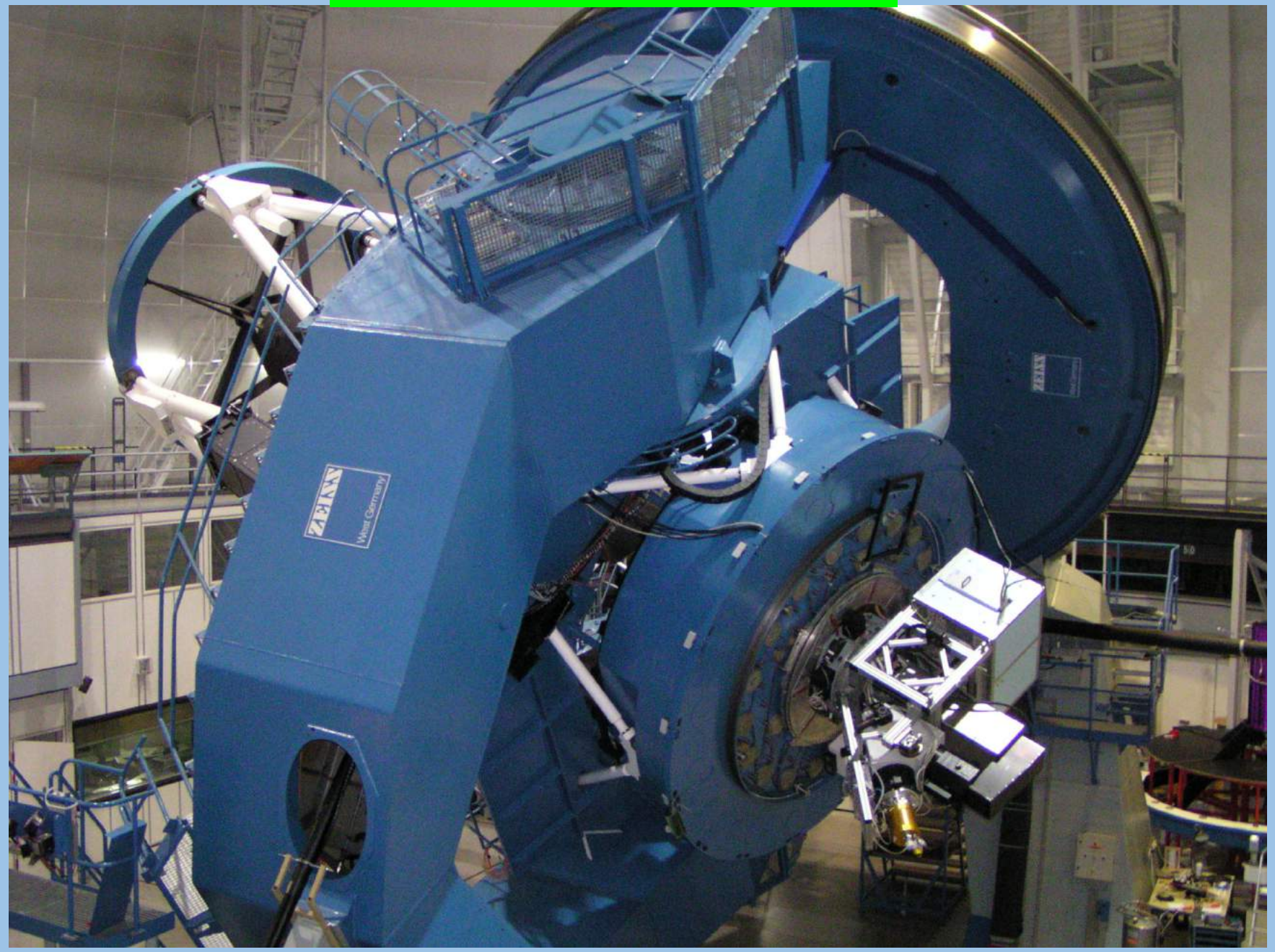
Sterne: Absorption

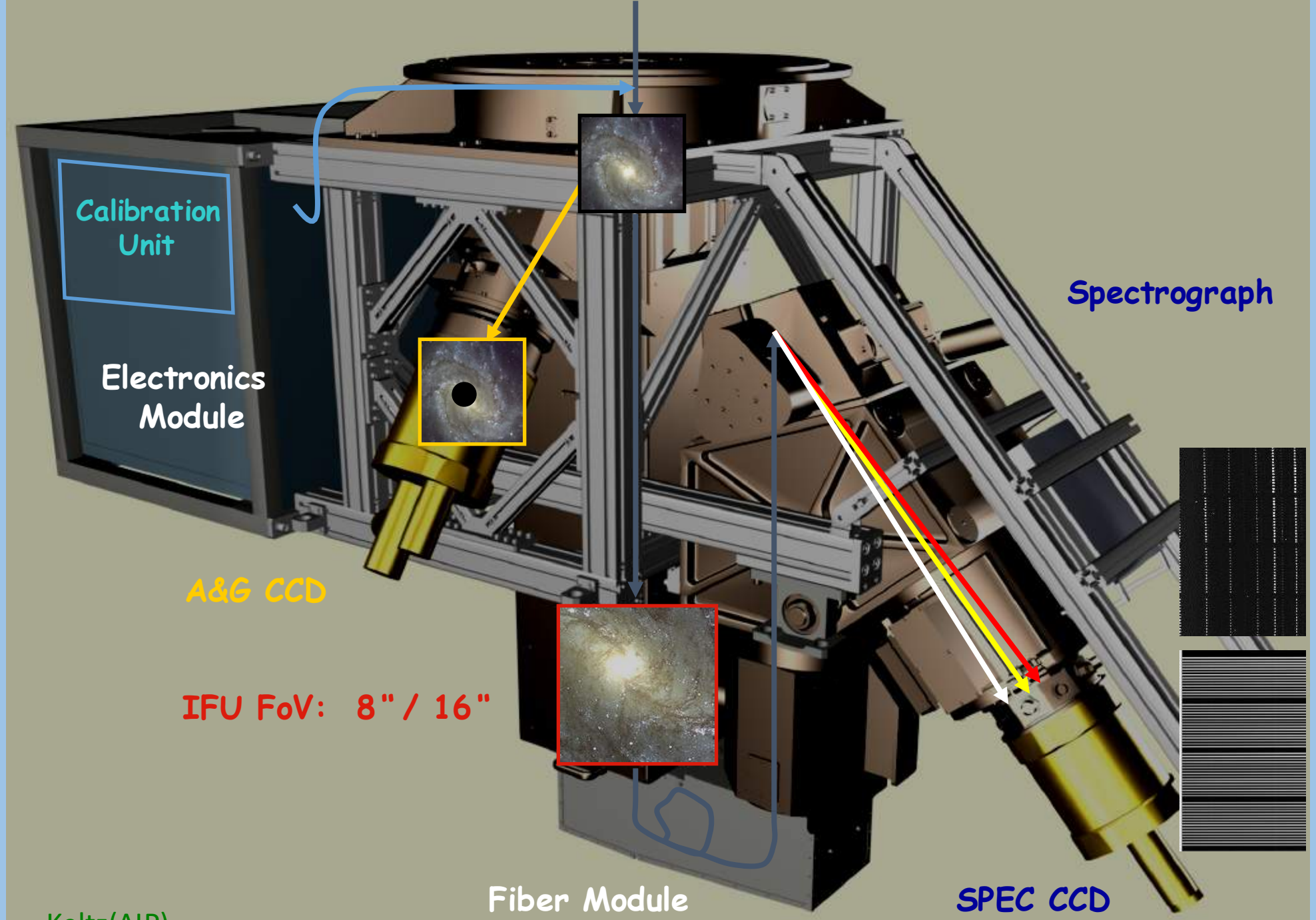
Wegner (USM)

Calar Alto Observatorium (CAHA)



PMAS 3D Spektrograph



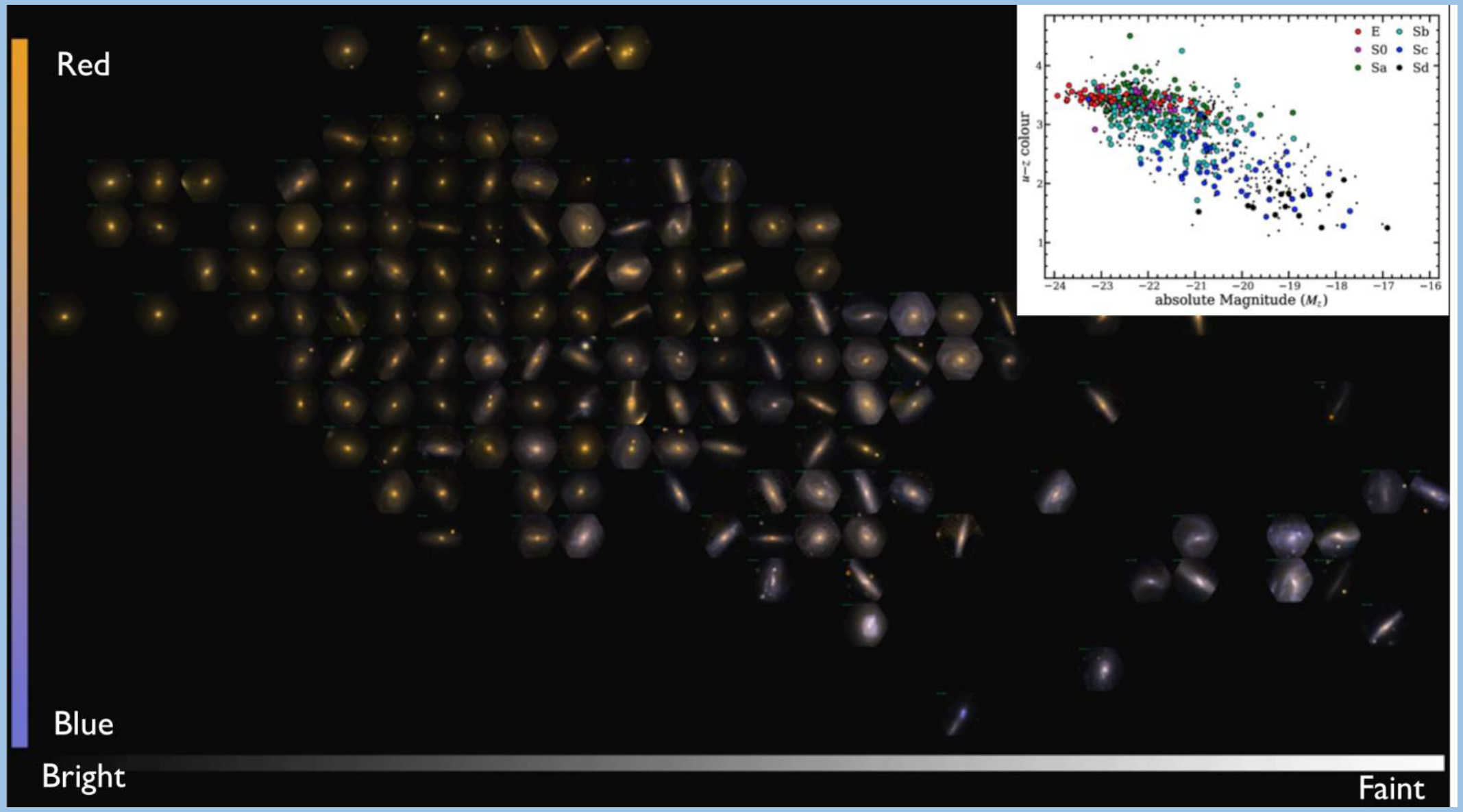

Calibration Unit
Electronics Module
Spectrograph
A&G CCD
IFU FoV: 8" / 16"
Fiber Module
SPEC CCD

Keltz(AIP)

CALIFA 3D Survey www.caha.es/CALIFA

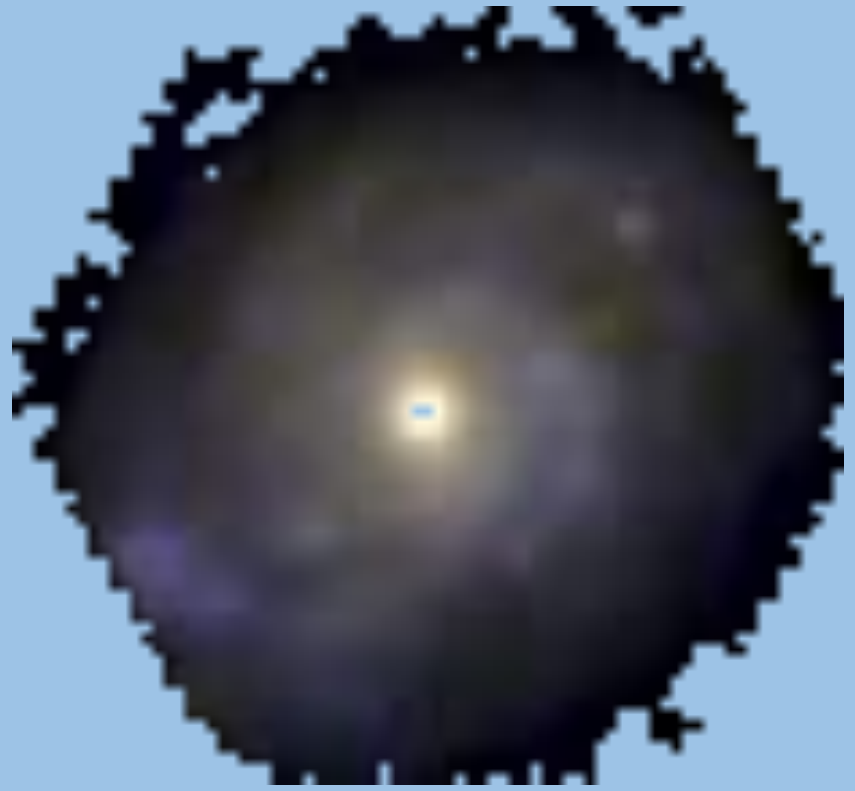
- 3D Spektroskopie mit PPAK/PMAS am 3.5m-T. CAHA
- 300 (dunkle) Nächte über 3,5 Jahre hinweg
- 80 Wissenschaftler von 20 Instituten in 7 Ländern
- PI: S. Sanchez (UNAM), PS: C.J. Walcher (AIP)
- 667 Galaxien im lokalen Universum (*0.005 < z < 0.03*)
- Alle Hubble Galaxientypen

CALIFA: Farben-Helligkeits-Diagramm

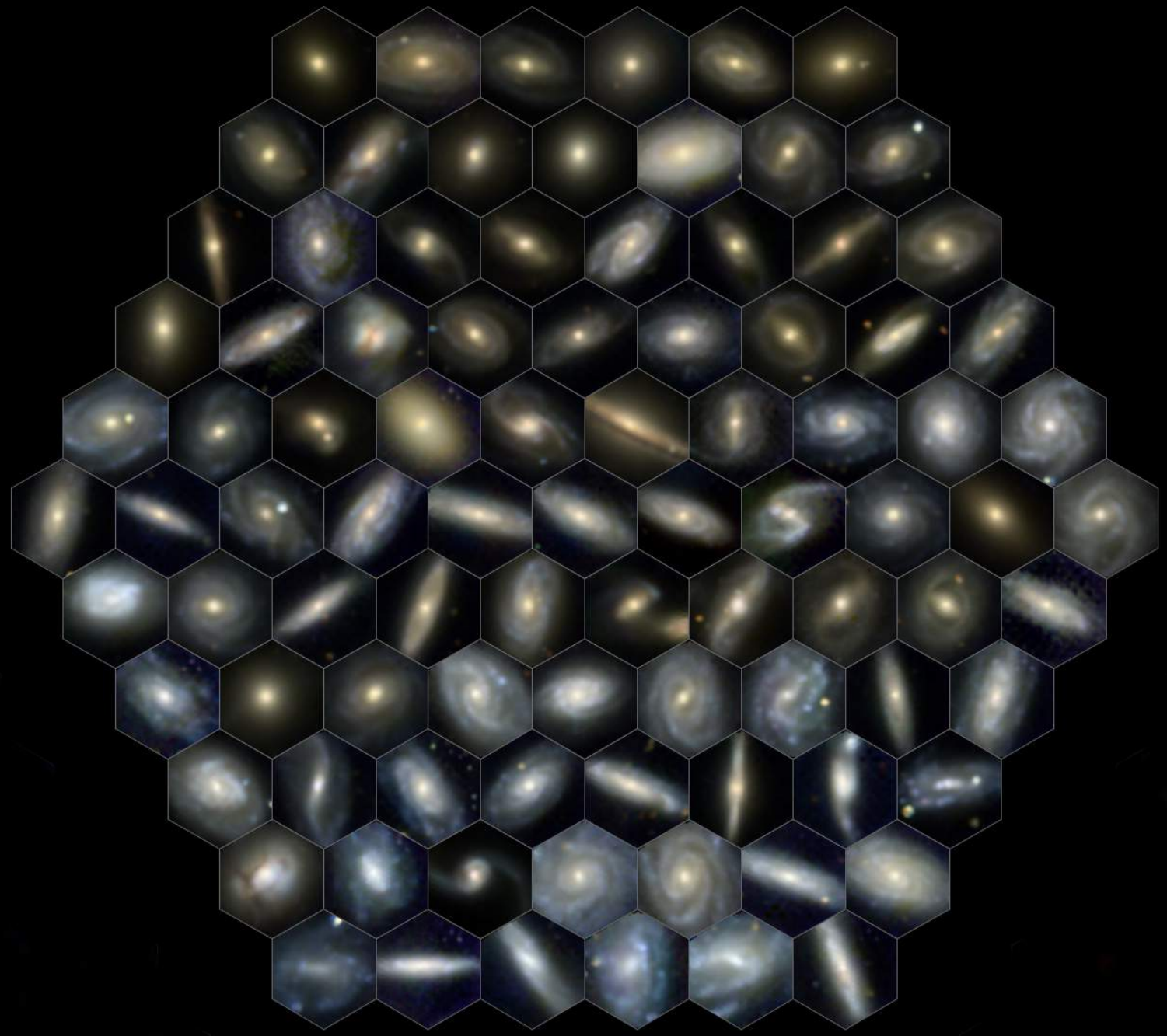


Spiralgalaxie NGC2253

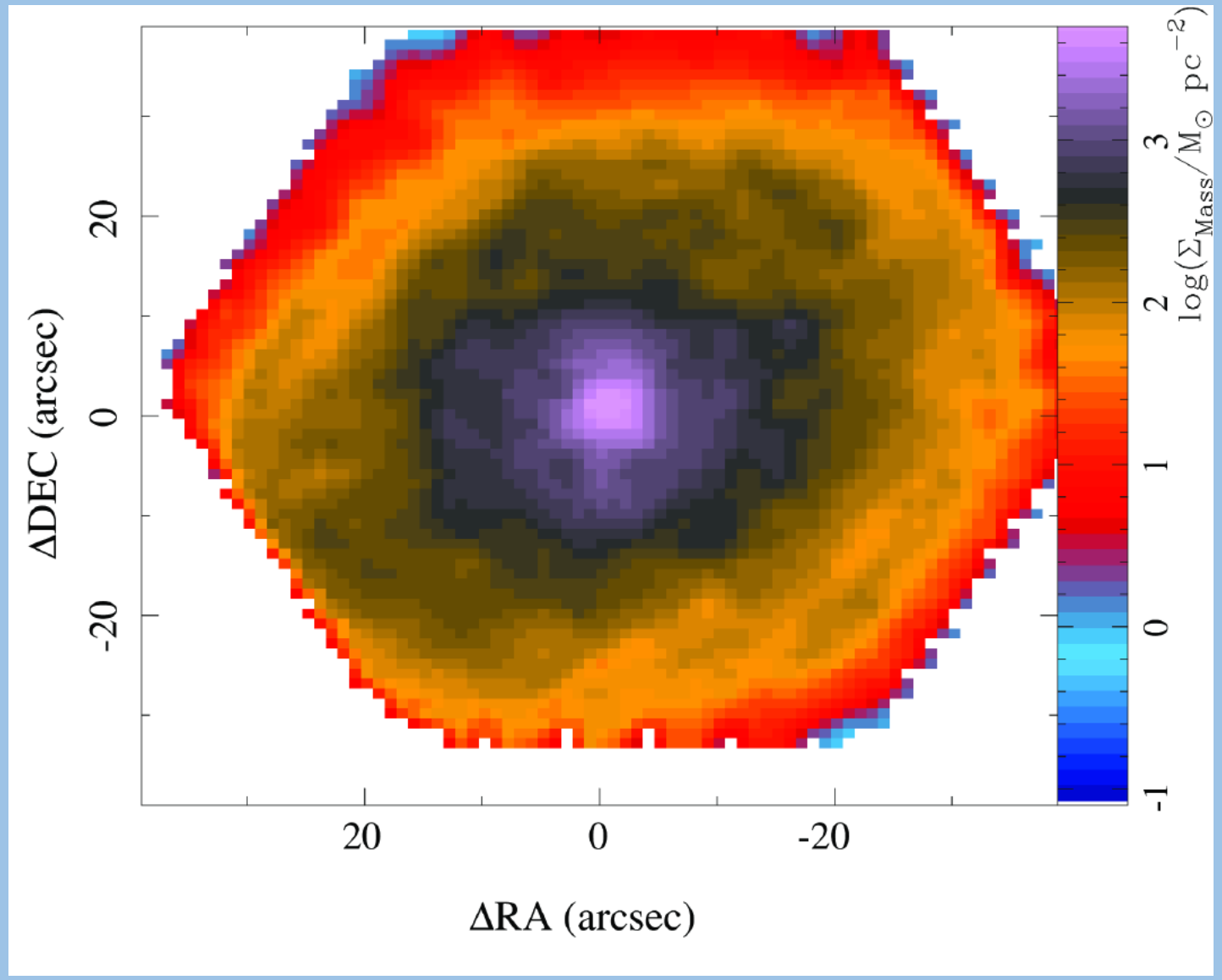
SDSS Bild

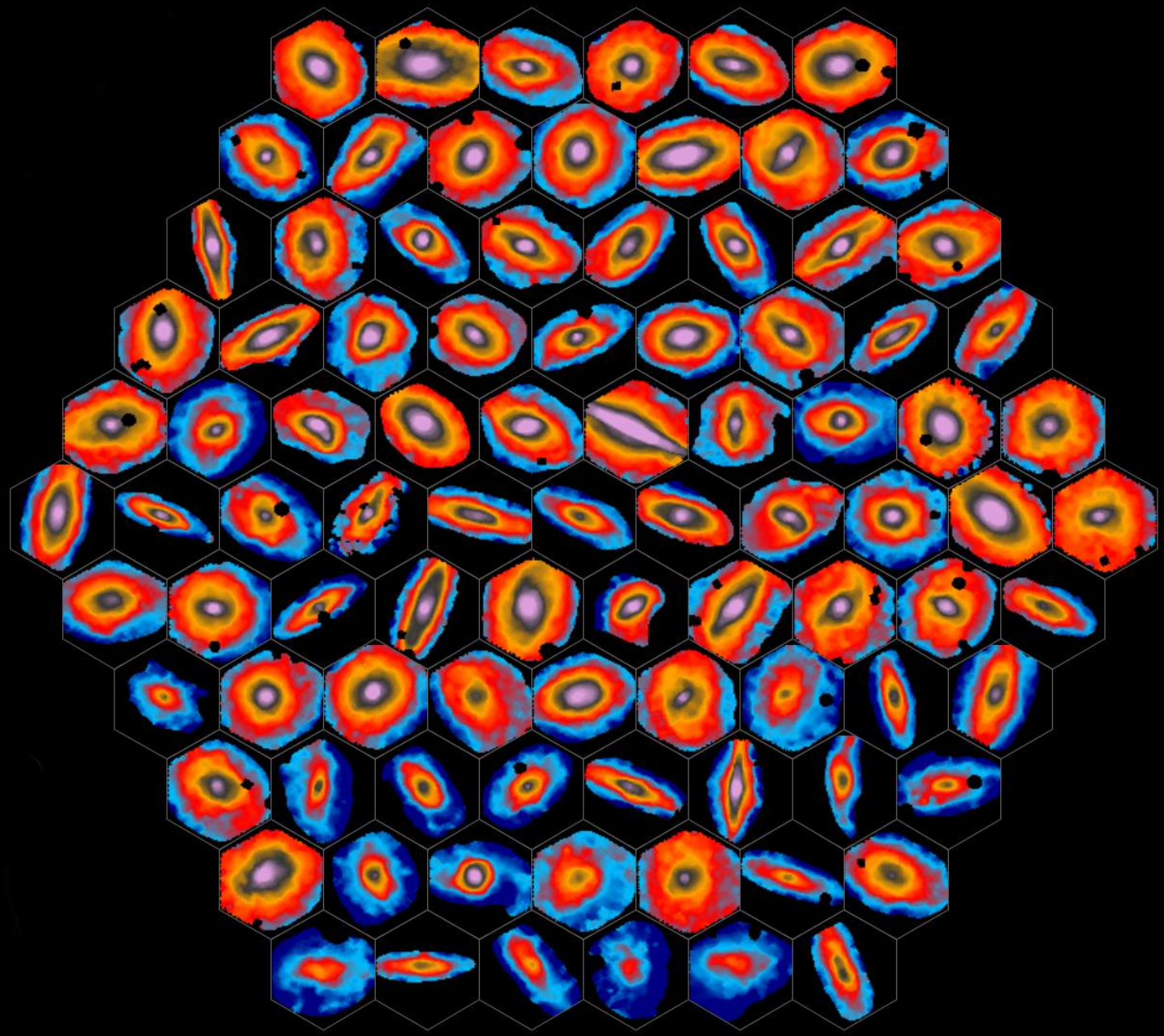


CALIFA Rekonstruktion

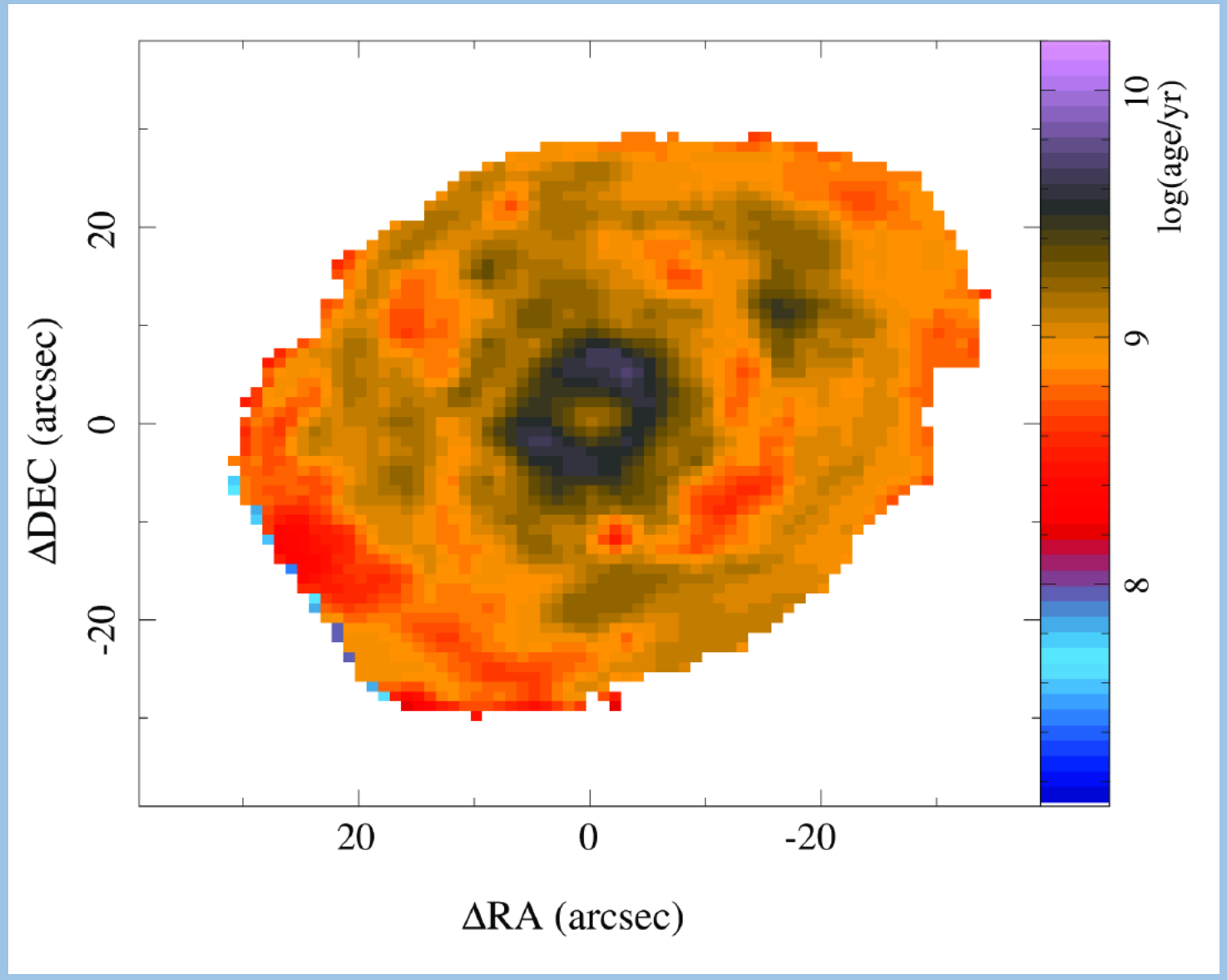


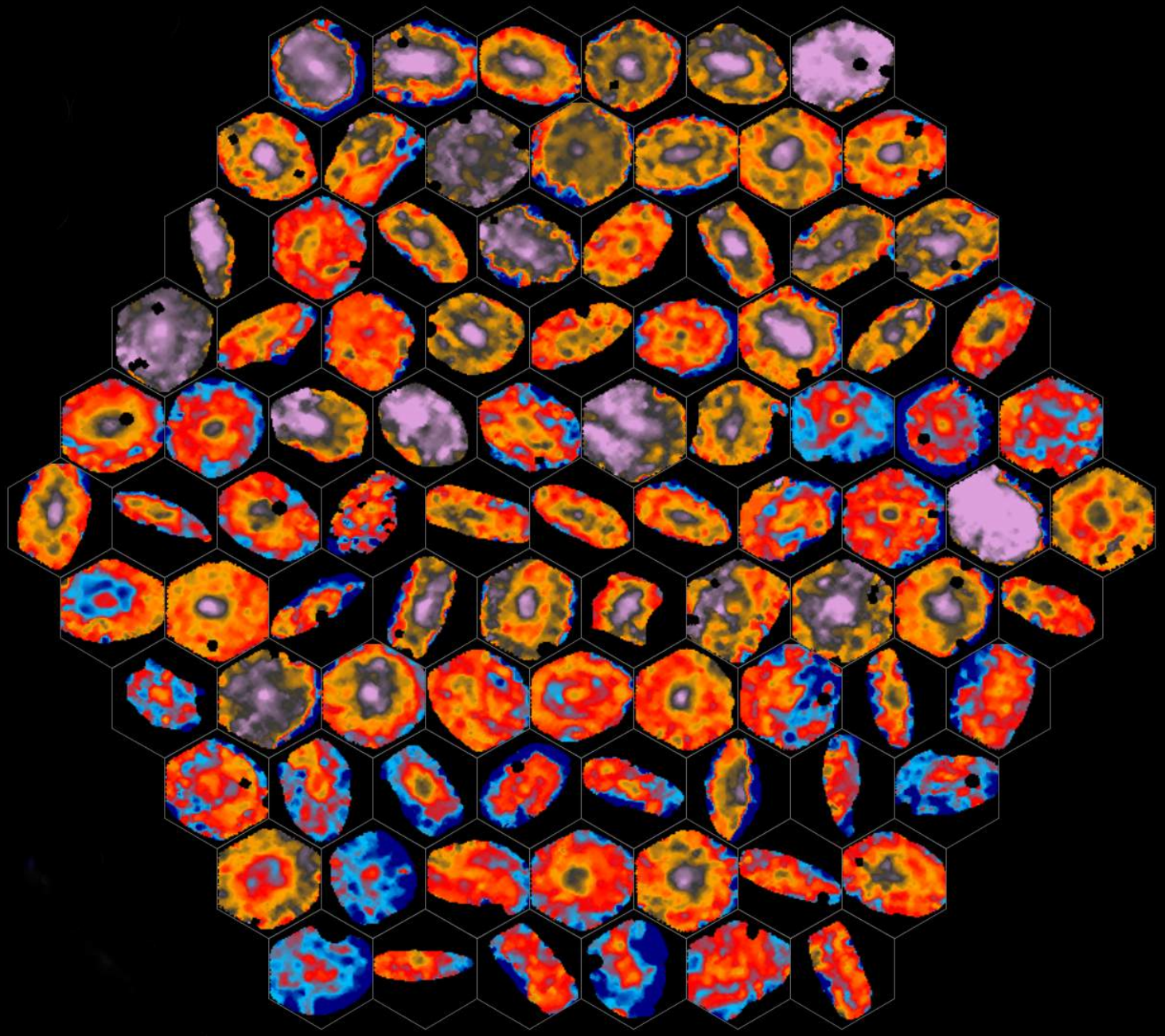
Verteilung der stellaren Masse



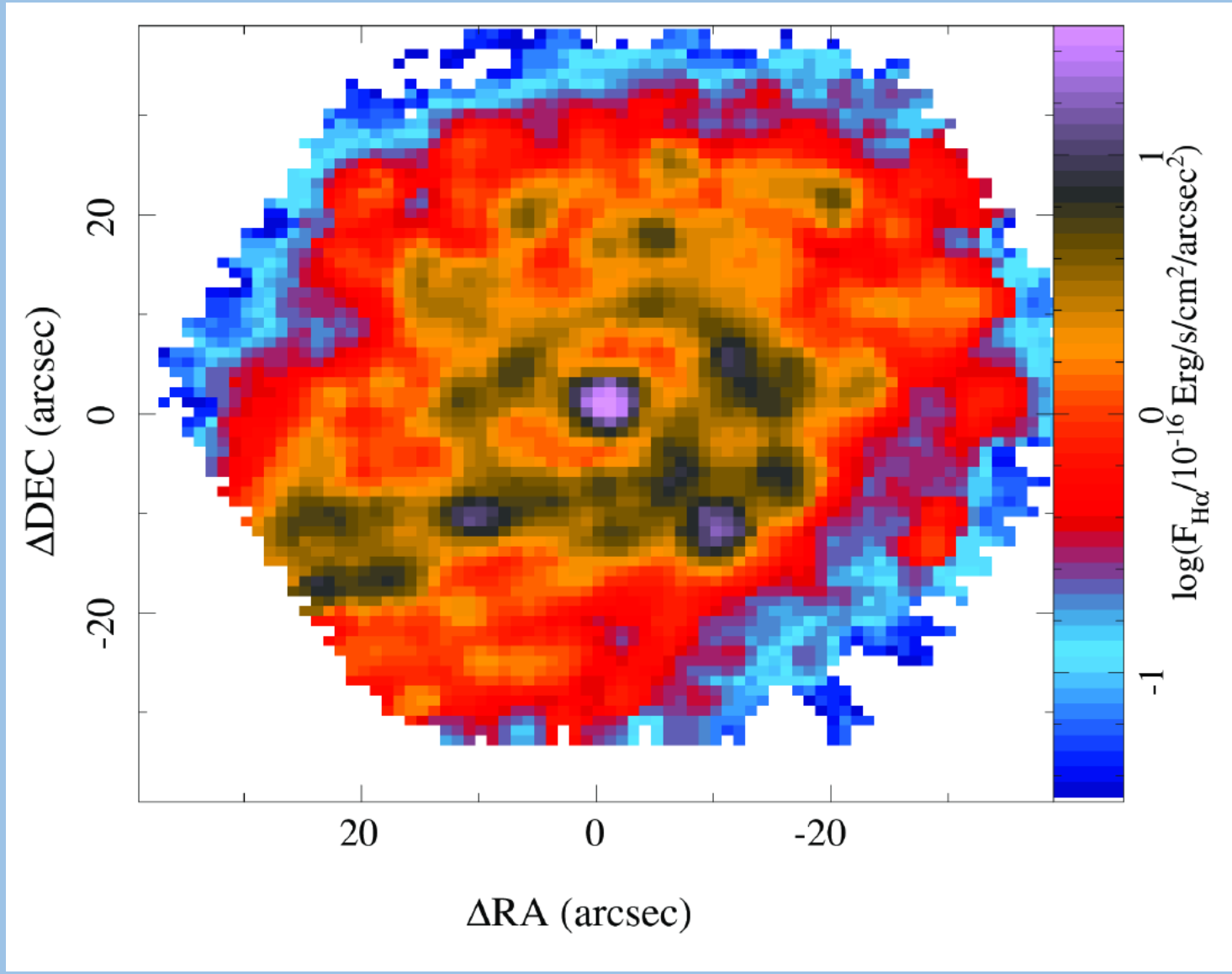


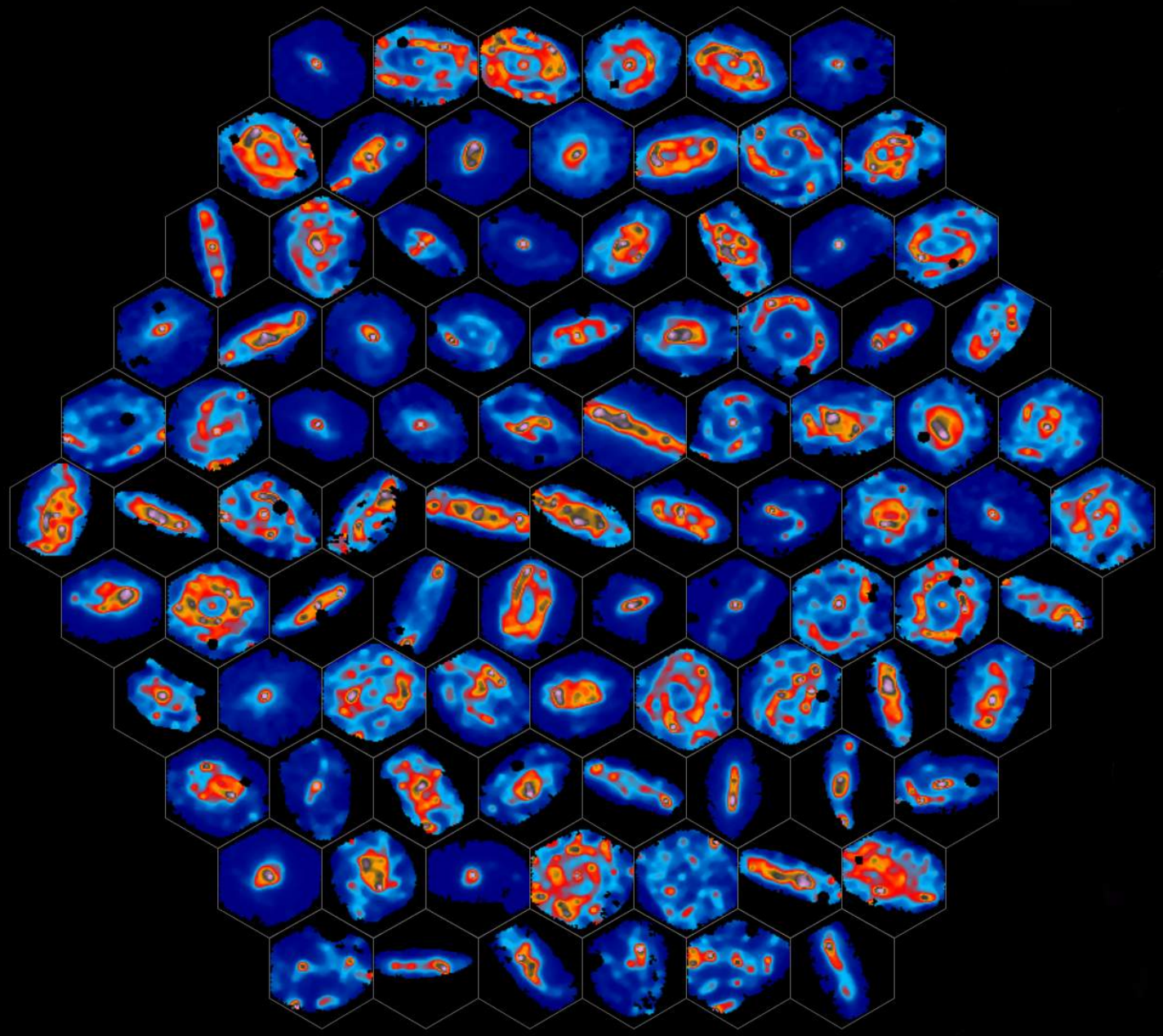
Verteilung des stellaren Alters



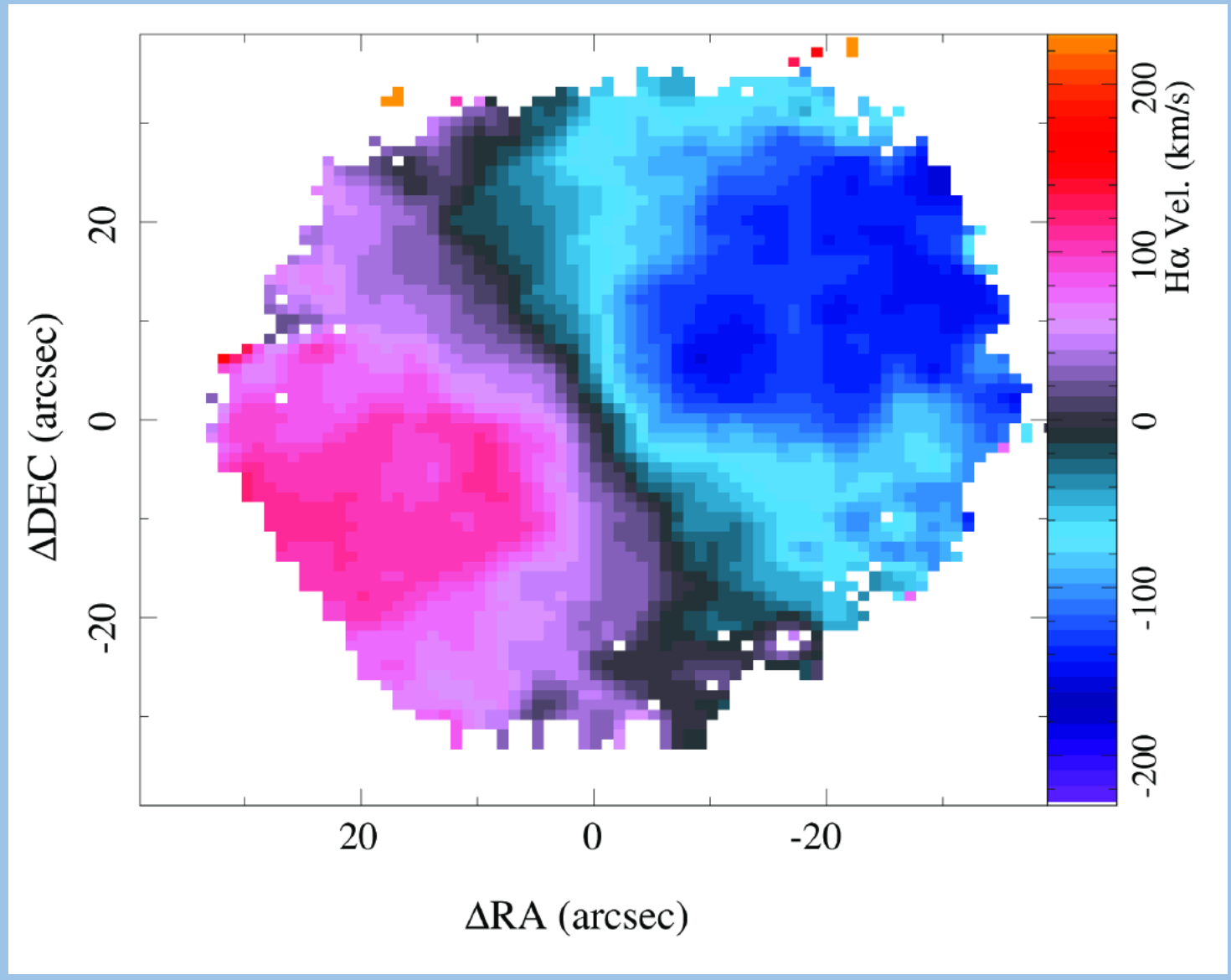


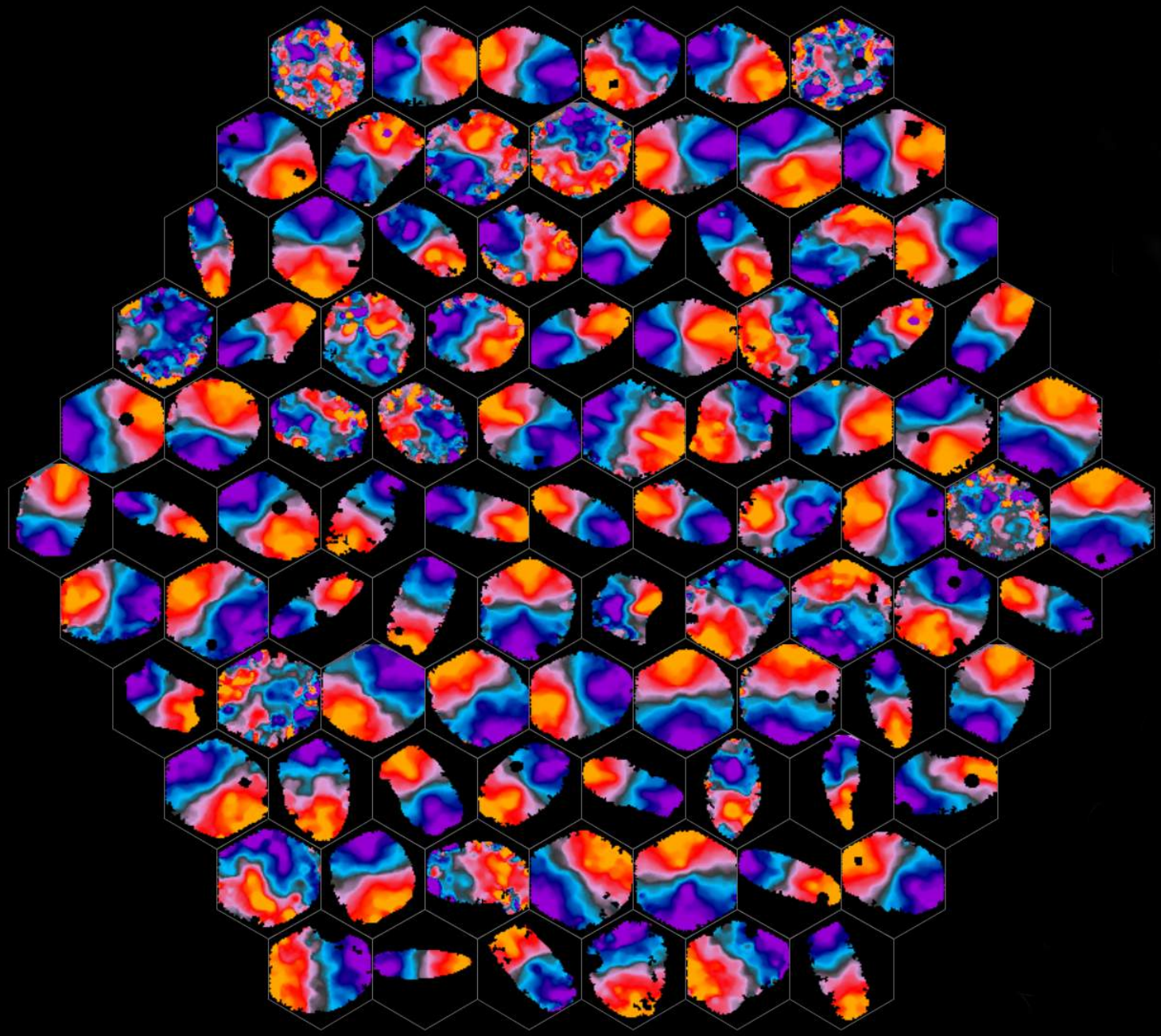
Verteilung der momentanen Sternentstehung



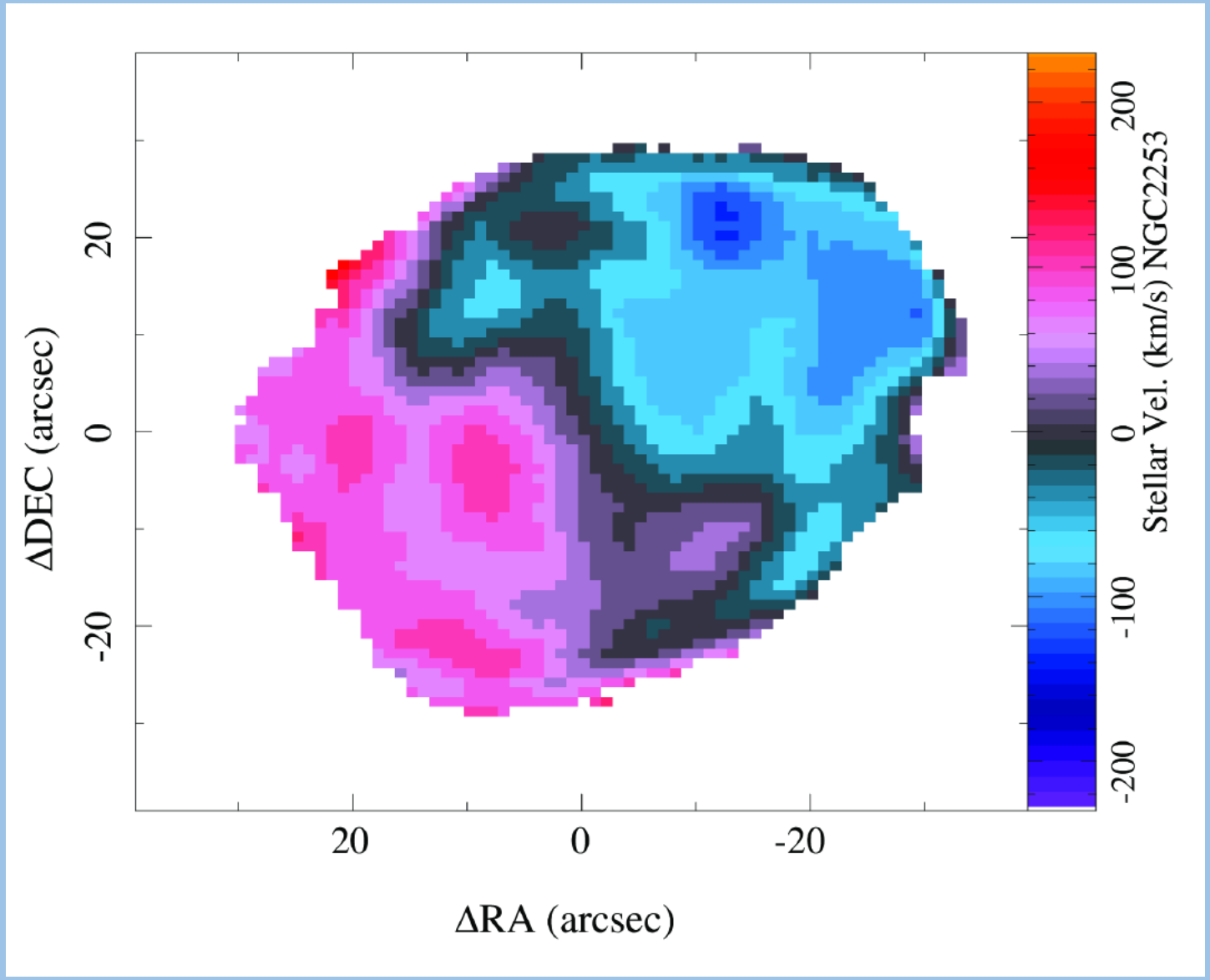


Geschwindigkeitsfeld des Gases





Geschwindigkeitsfeld der Sterne



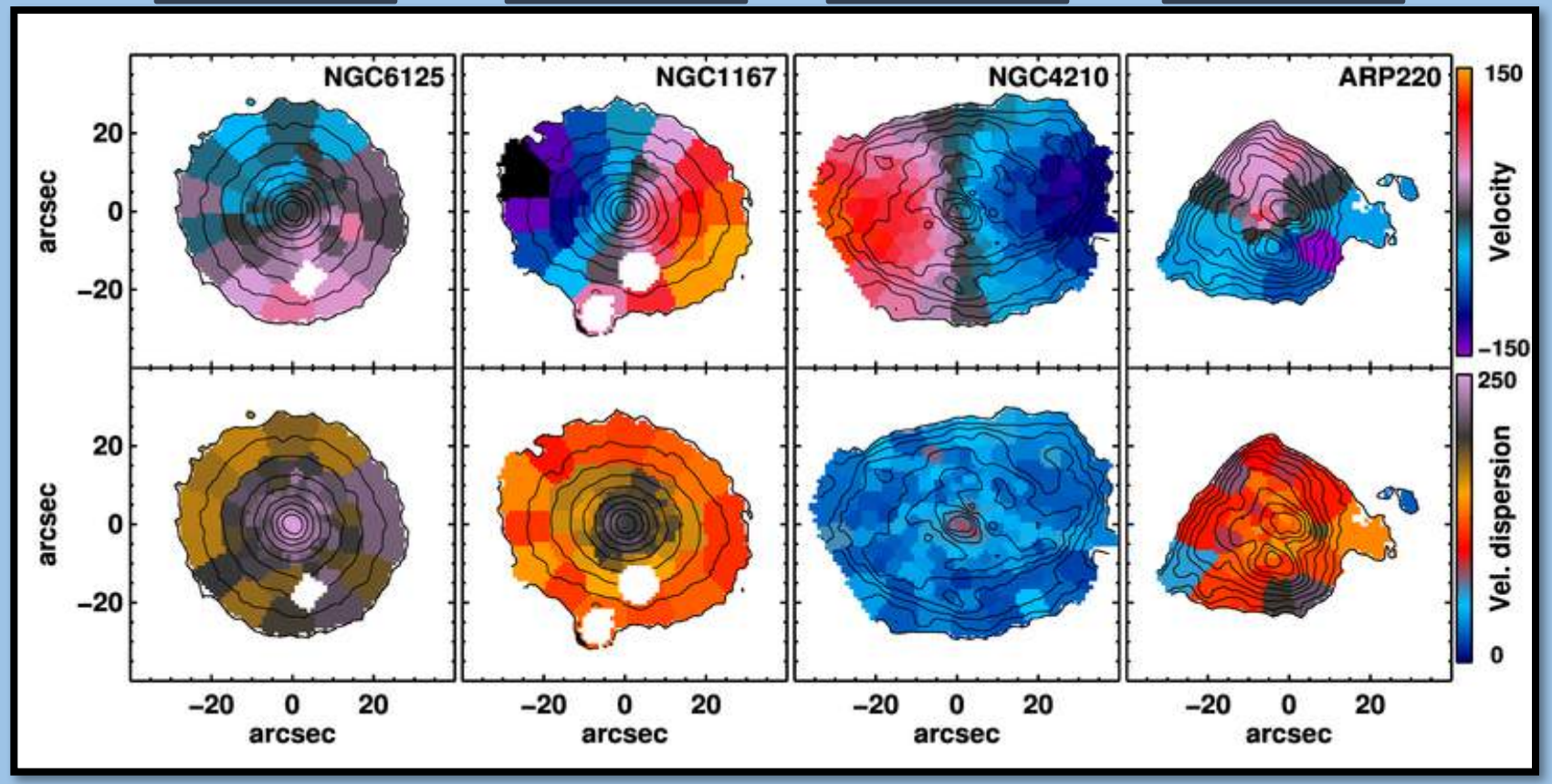
Stellare Kinematik der Galaxien

Rotation

Chaos

Velocity

Vel. dispersion



Slow Rotator (low V, high σ)

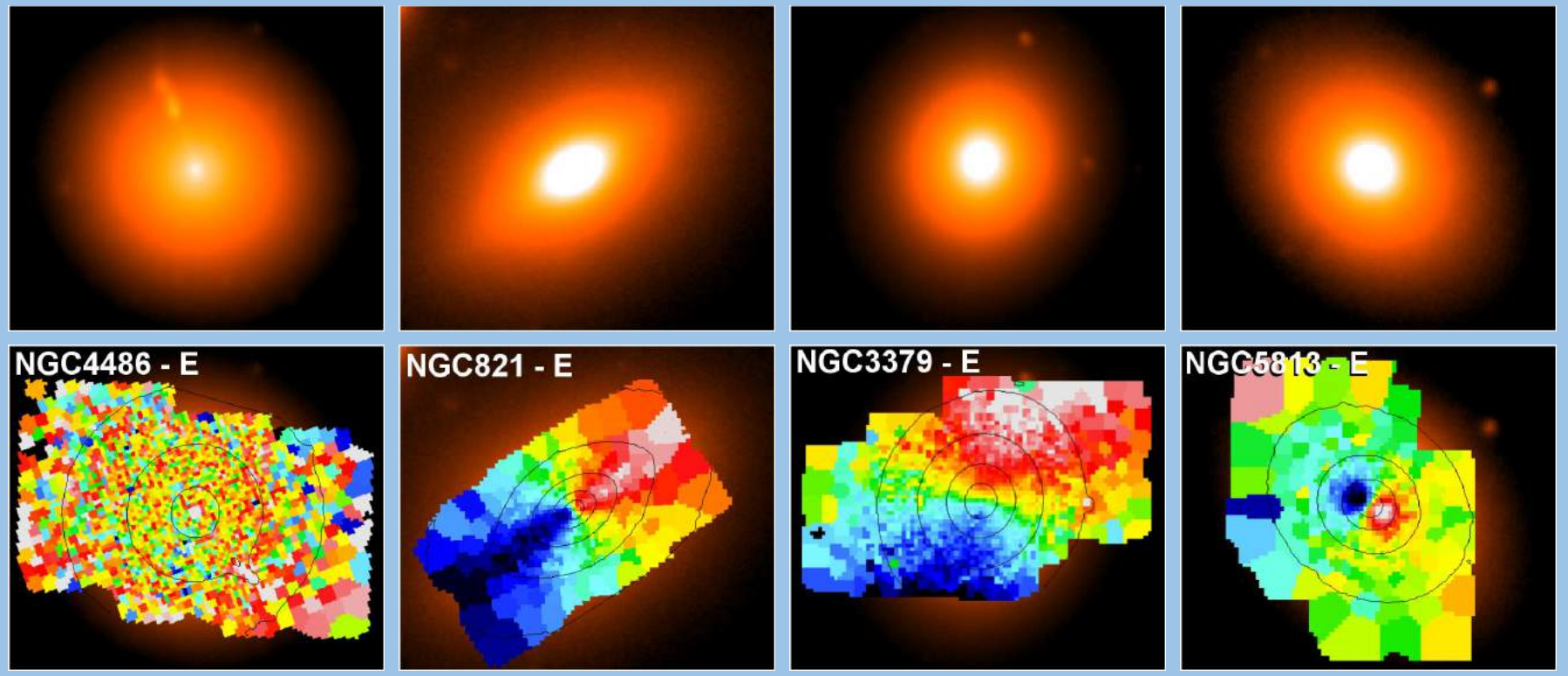
Bulge + Disk (high V, high σ)

Pure disk (high V, low σ)

Interacting (e.g. ARP220)

J.F. Barroso

Stellare Kinematik der Elliptischen Galaxien



Elliptische Galaxien haben ähnliche Struktur (Aussehen),
aber ganz verschiedene Kinematik (Geschwindigkeitsfelder),
sind also physikalisch vielfältige Objekte.

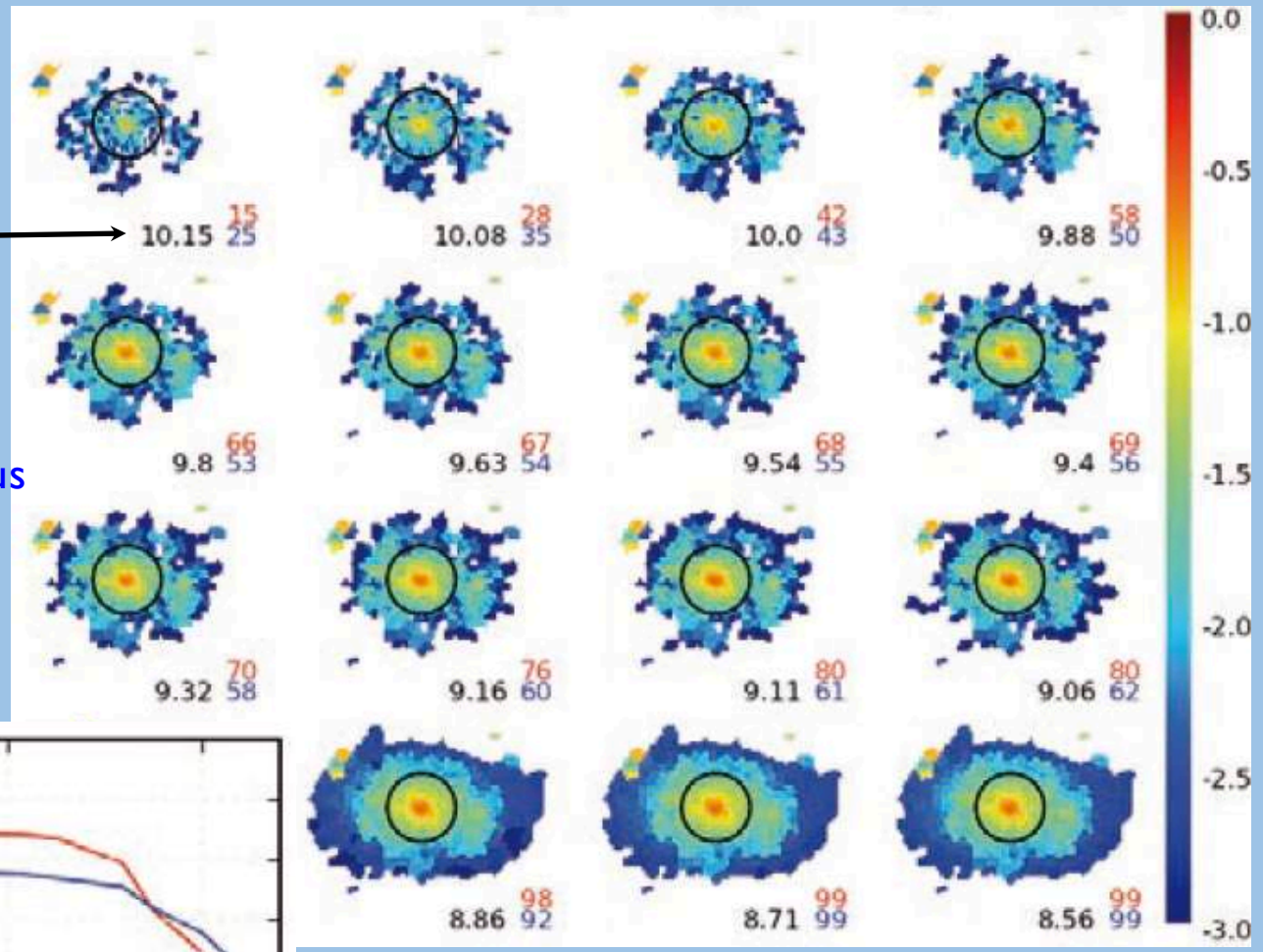
J.F. Barroso

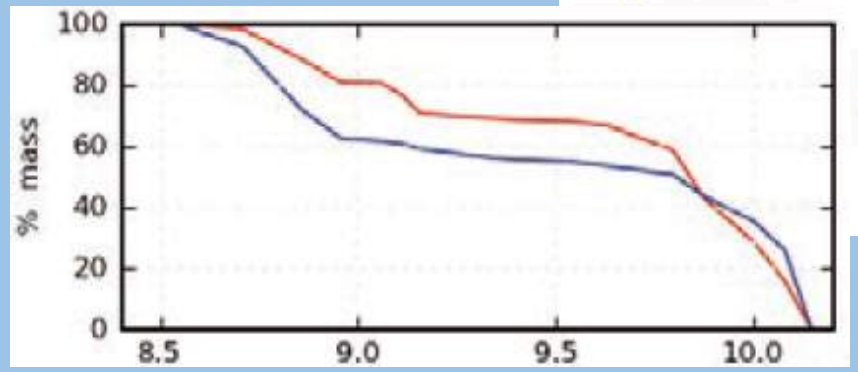
Massen Wachstum

surface mass density M_{sun}/pc^2

look-back time log(t/Gyr)

inside current half-light radius
outside current half-light radius

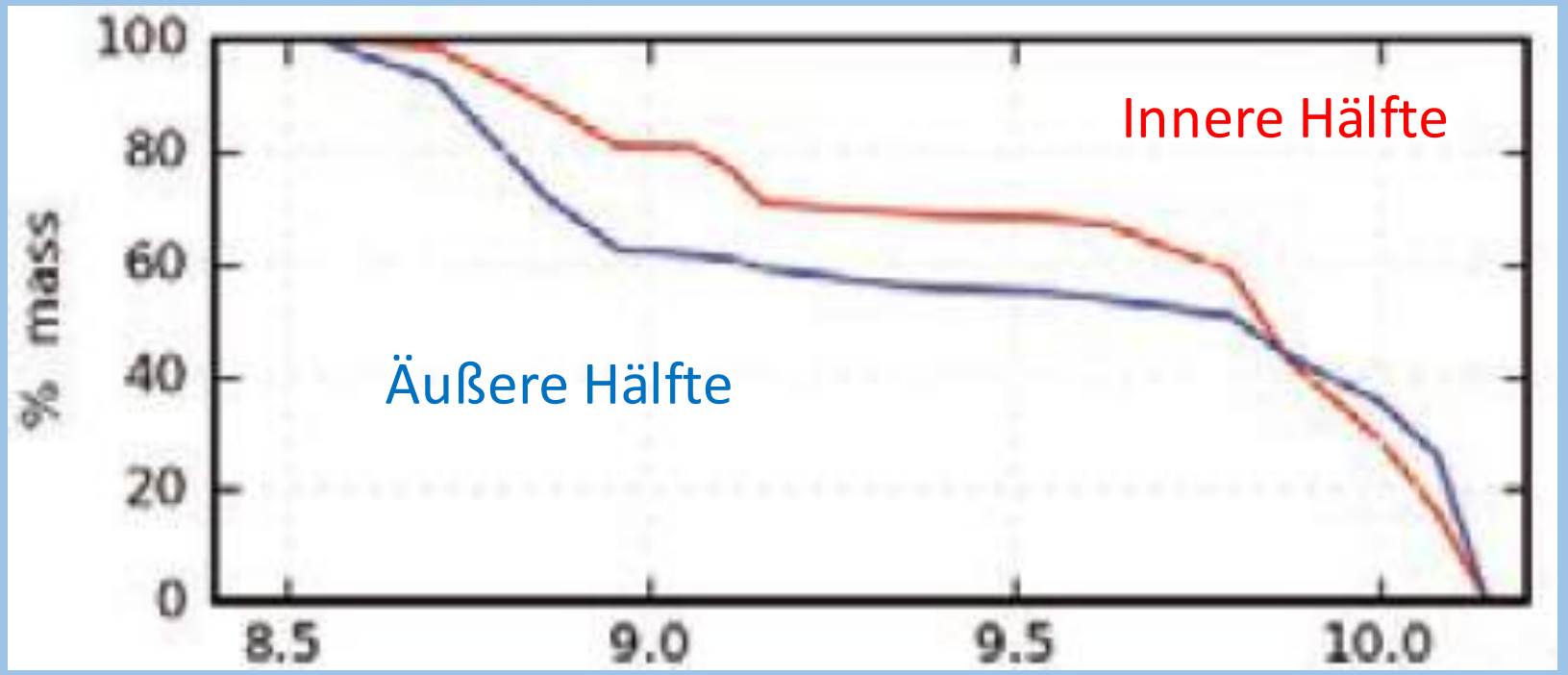




Pérez et al. (2013)

Van de Ven

Massen Wachstum



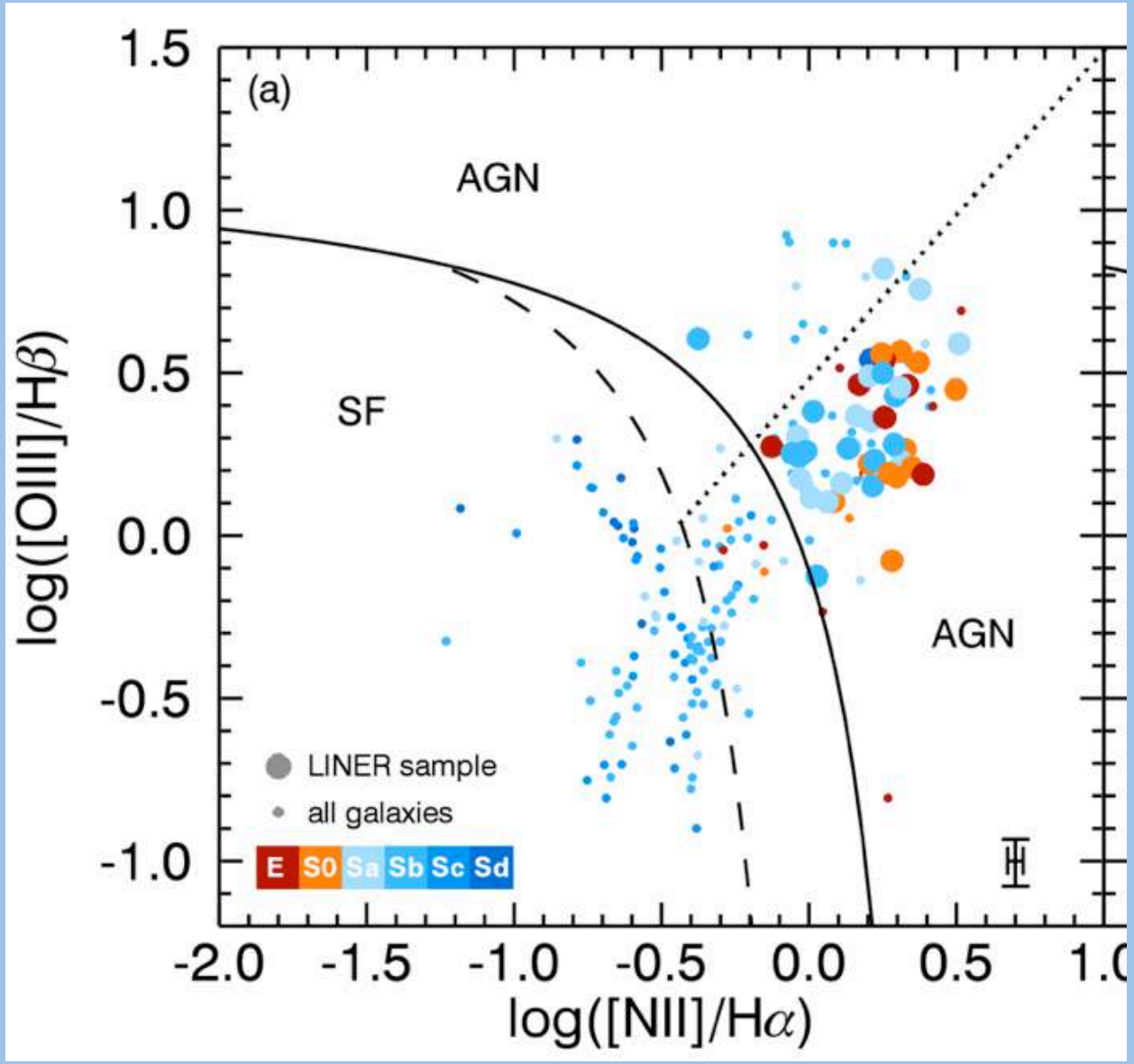
1 Mrd

10 Mrd Jahre

Rückblickzeit ->

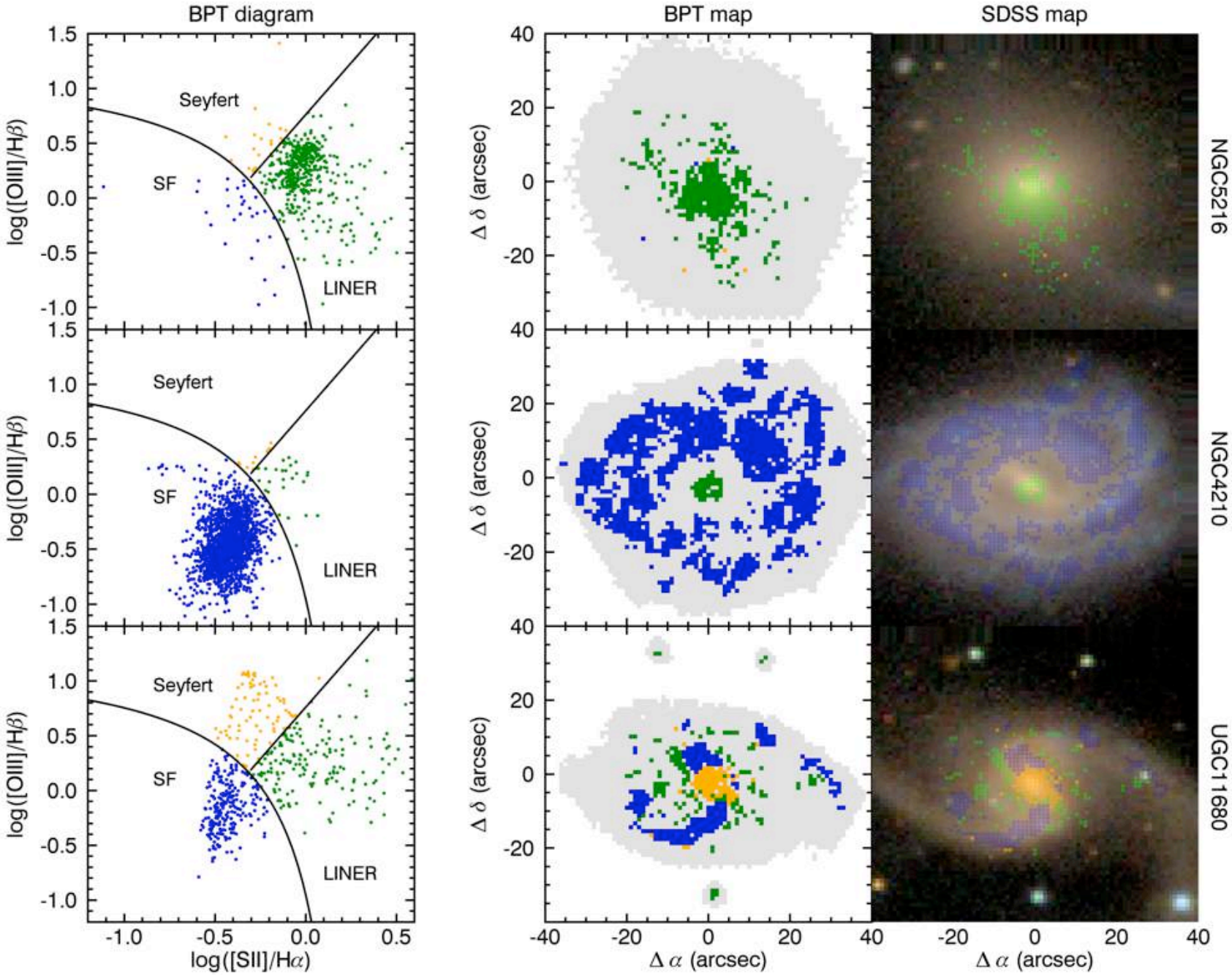
Inside-out Growth

Aktive Schwarze Löcher



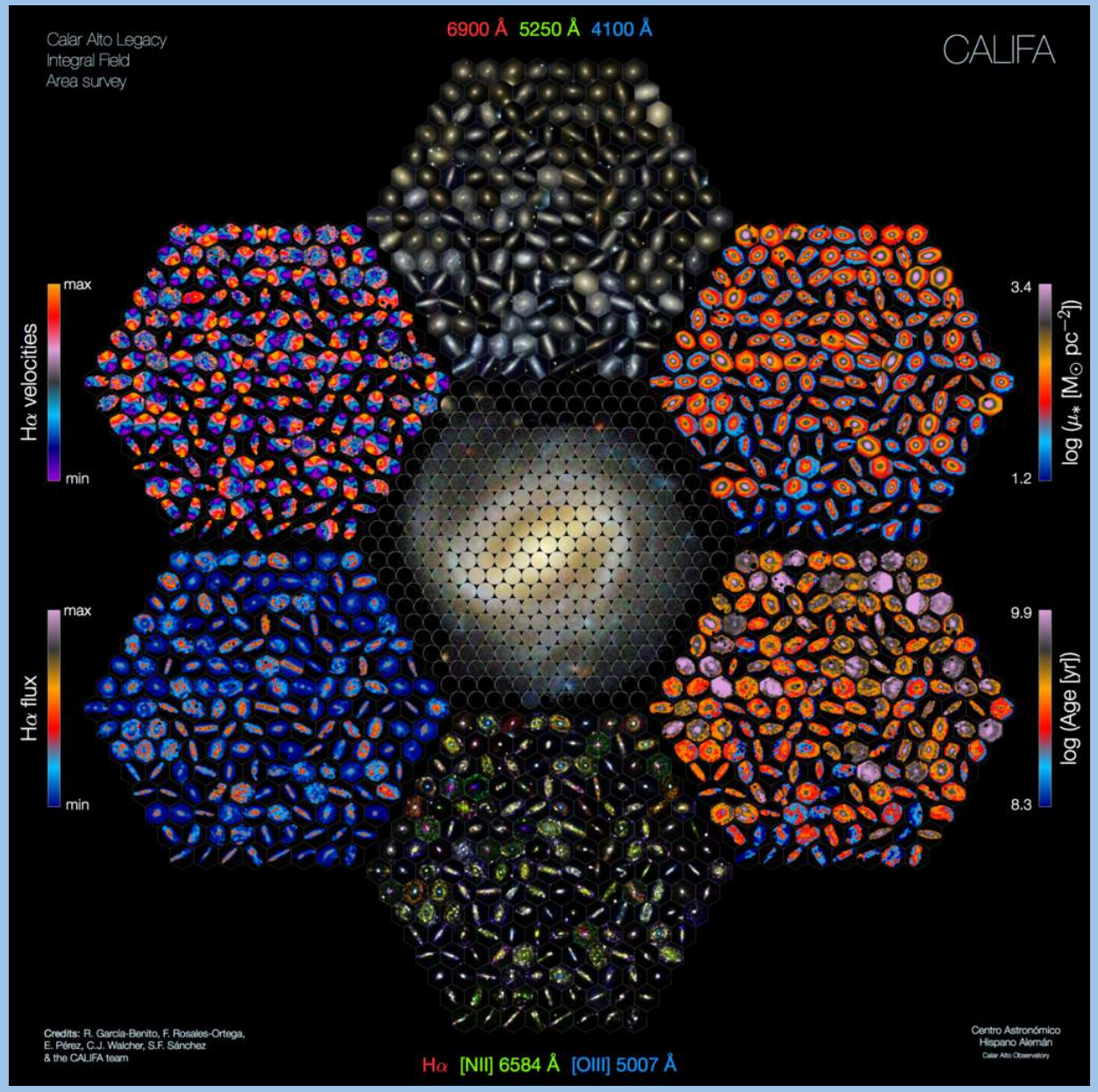
Singh et al. 2013

Aktive Schwarze Löcher ?



Singh et al. 2013

CALIFA: 3D Physik der Galaxien



Bodo Ziegler

Institut für
Astrophysik
Universität Wien