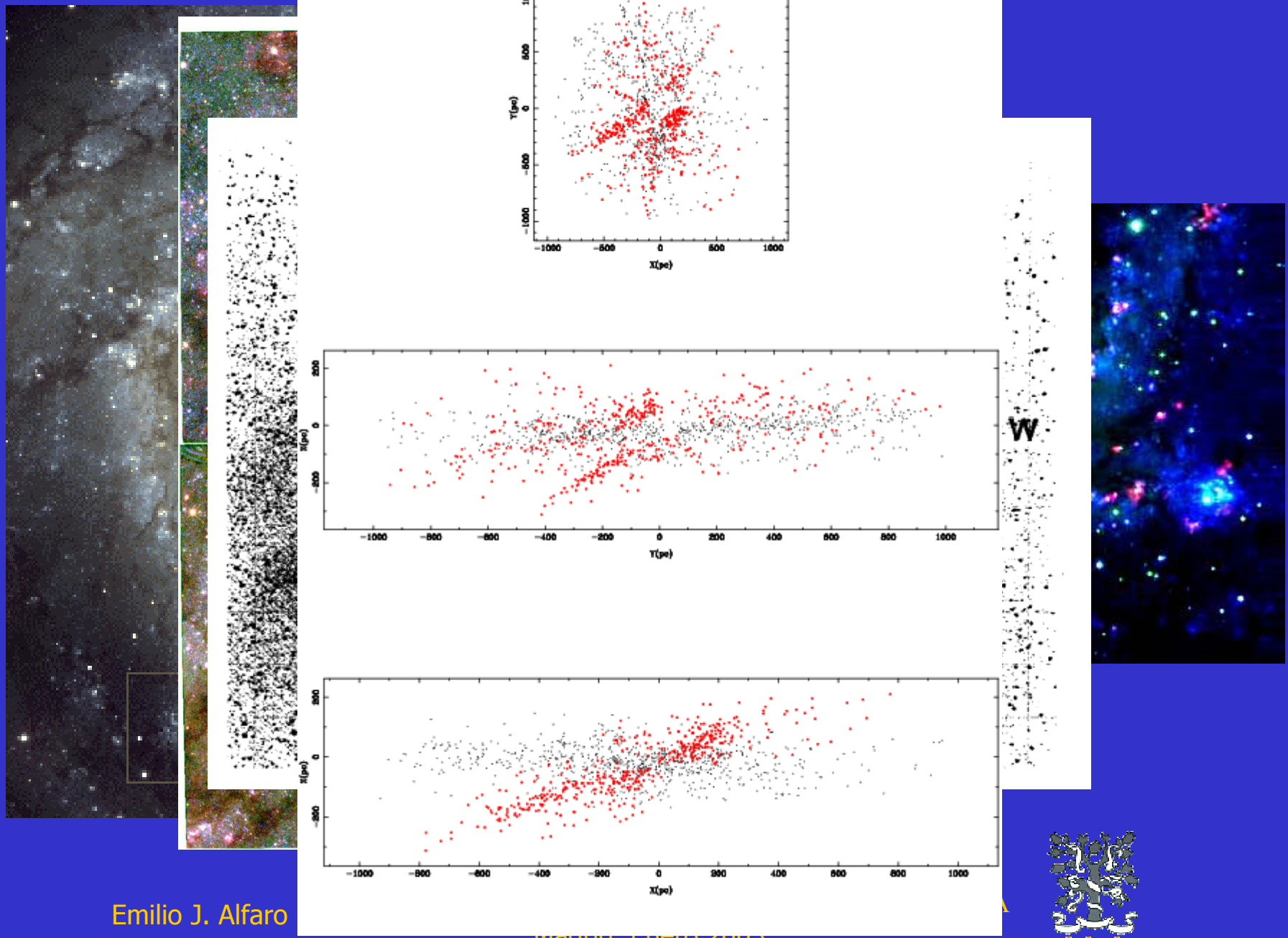
Complejos Estelares

- Introducción
- Distribución espacial
  - Espaciamientos
  - Corrugaciones
- Campo de velocidad
  - Componente vertical de la velocidad
- Complejos Peculiares
  - NGC 6946
- Líneas Futuras

Introducción

- La mayor escala espacial de formación estelar "coherente" en una galaxia. [Efremov (1978, 1995), Elmegreen & Elmegreen (1983)].
  - Tamaño: 1 kpc
  - Rango de edad: 2-5 x 10^7 años

    $\Delta t = 0.9 \times 10^6 (L/pc)^{0.5}$ (Elmegreen & Efremov 1996)
  - Masas: 10^6-10^7 M_o
  - Ejemplos: Gould Belt; 30 Dor; NGC 6946



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Madrid, Enero 2005

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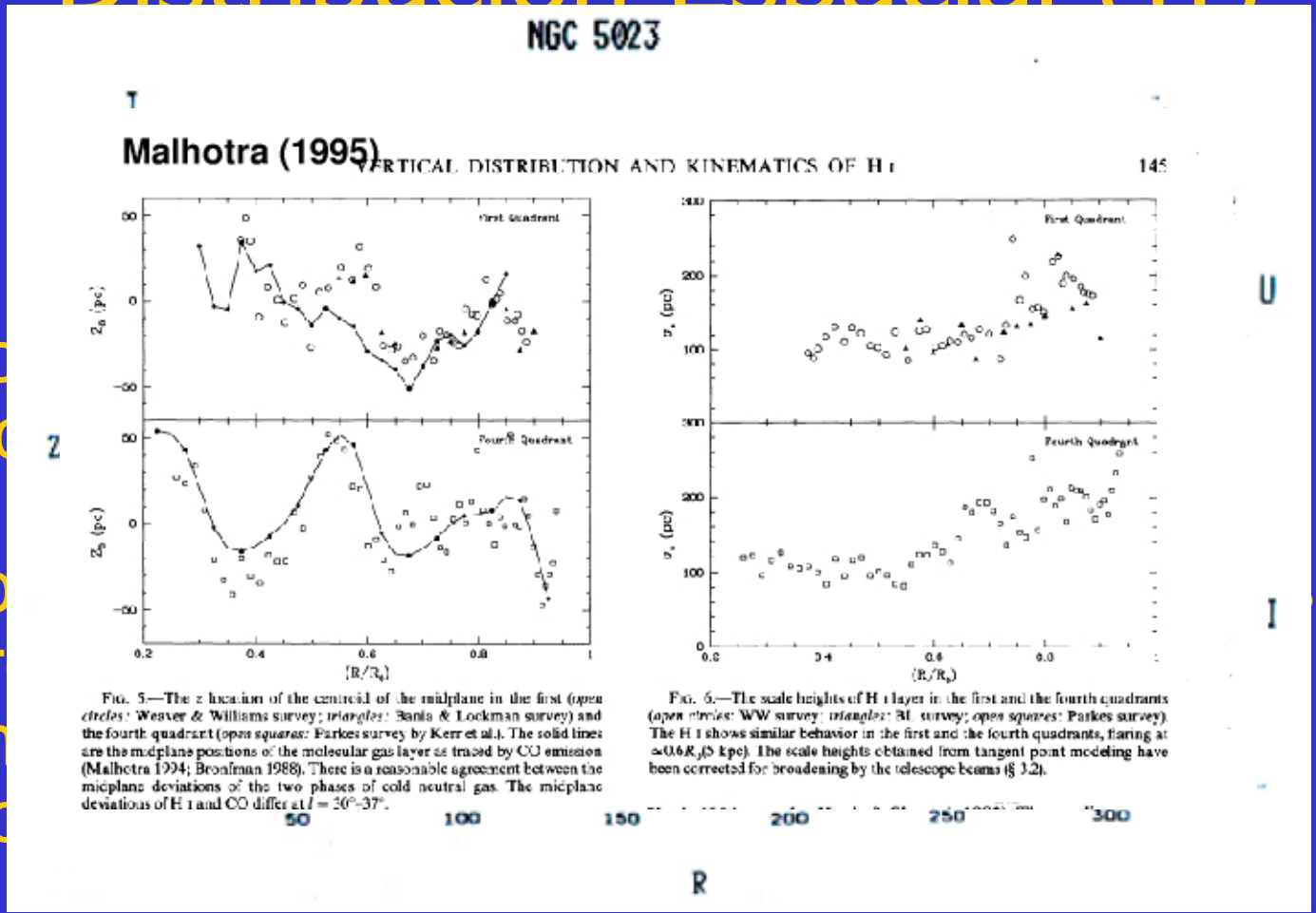
Distribución Espacial (I)

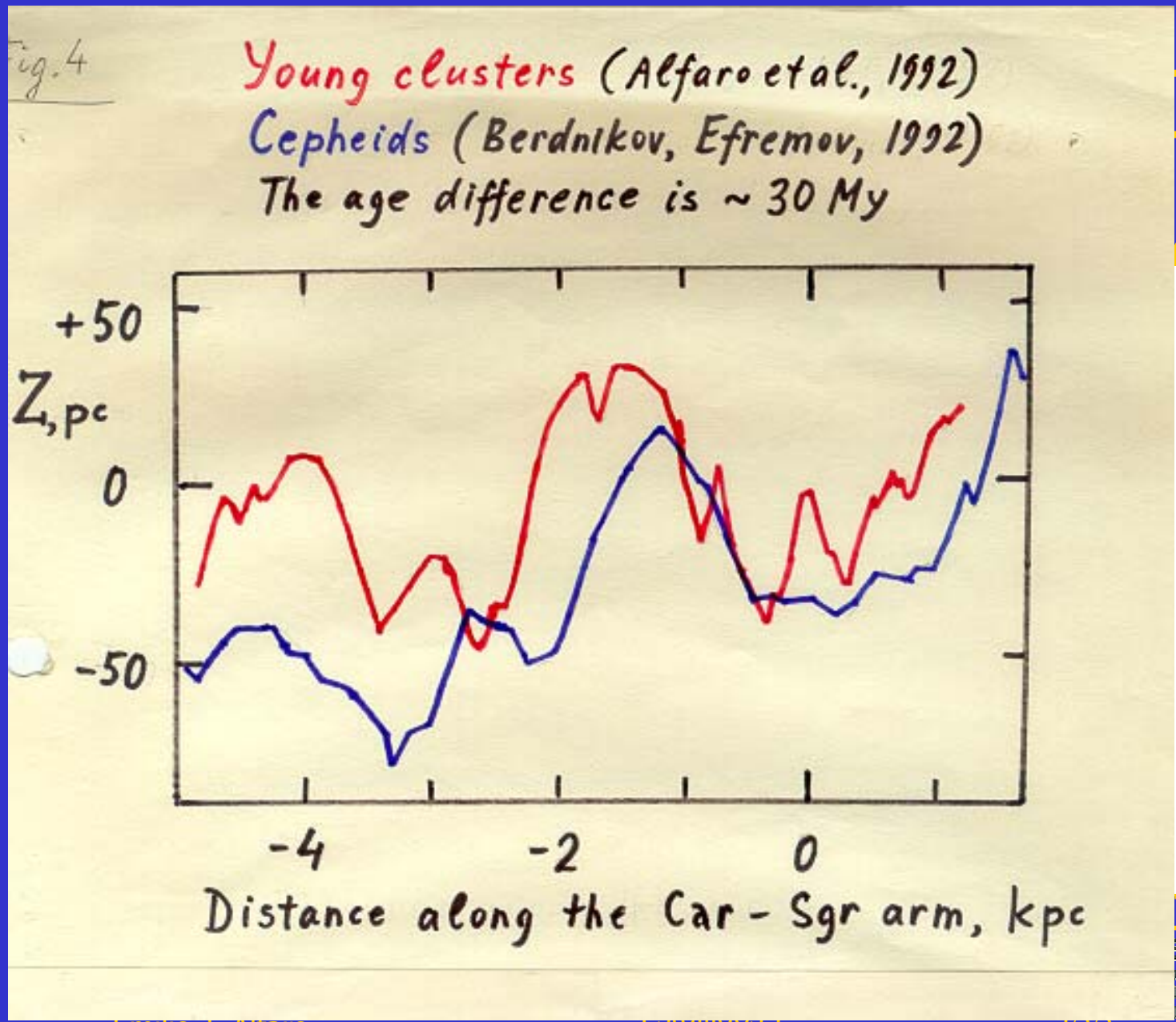
- Espaciamientos: En galaxias espirales la distribución de regiones HII gigantes y las grandes nubes de HI muestran un alto grado de estructura.
  - Cadenas regulares con longitudes características (λ=1–4 kpc) alineadas a lo largo de los brazos espirales. λ proporcional a D_{25} ;K= 0.2 (E&E 1983).
  - En el brazo de Carina-Sagitario se observa en HI (Efremov 1995) así cómo en la componente estelar (Avedisova 1989).

Distribución Espacial (II)

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Malhotra (1995)





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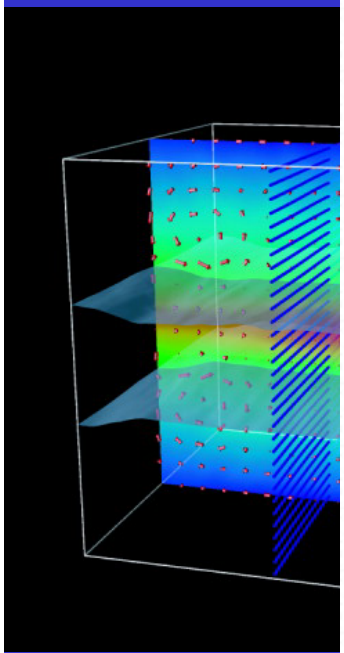
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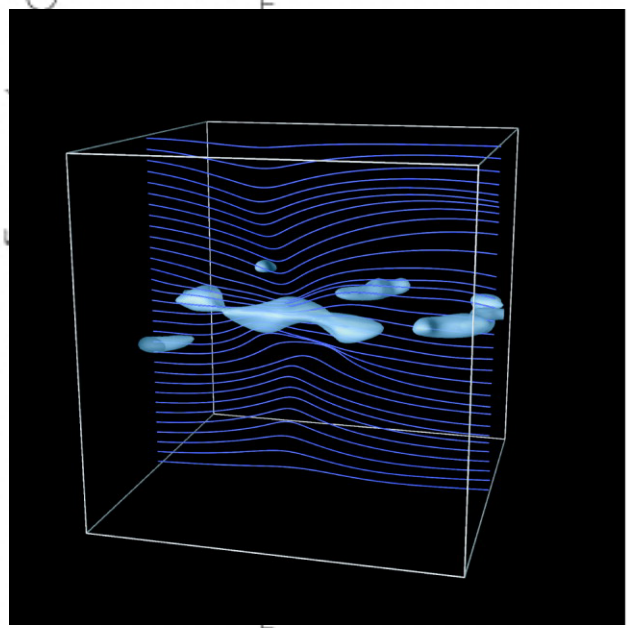
Distribución espacial (IV)

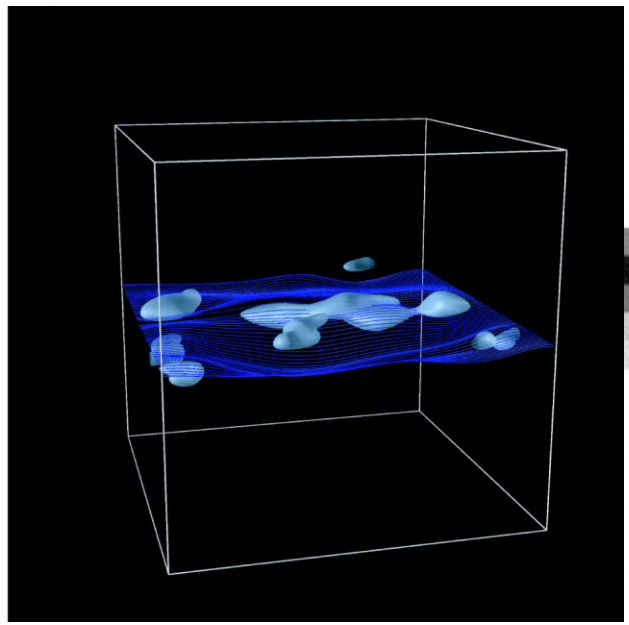
- Estructura vertical: Escenarios y modelos
  - Choques con nubes de alta velocidad (Tenorio-Tagle et al. 1981; Alfaro et al. 1991; Cabrera-Caño et al. 1995; Franco et al. 1995; Santillán et al. 1999, 2000)
  - Inestabilidades gravitatorias (Nelson & Matsuda 1980; Elmegreen 1994)
  - Inestabilidad de Parker en discos magnetizados (Kim et al. 1997, 1999, 2001; Franco et al. 2002)
  - Disco autogravitante en un halo asimétrico (Sparke 1995)
  - Acoplamiento no lineal entre onda espiral y alabeo (Masset & Tagger 1997)
  - Interacción entre galaxias (Edelsohn & Elmegreen 1997)
  - Bomba hidráulica: Interacción de una onda espiral con un disco grueso magnetizado (Martos & Cox 1998; Gómez & Cox 2002)

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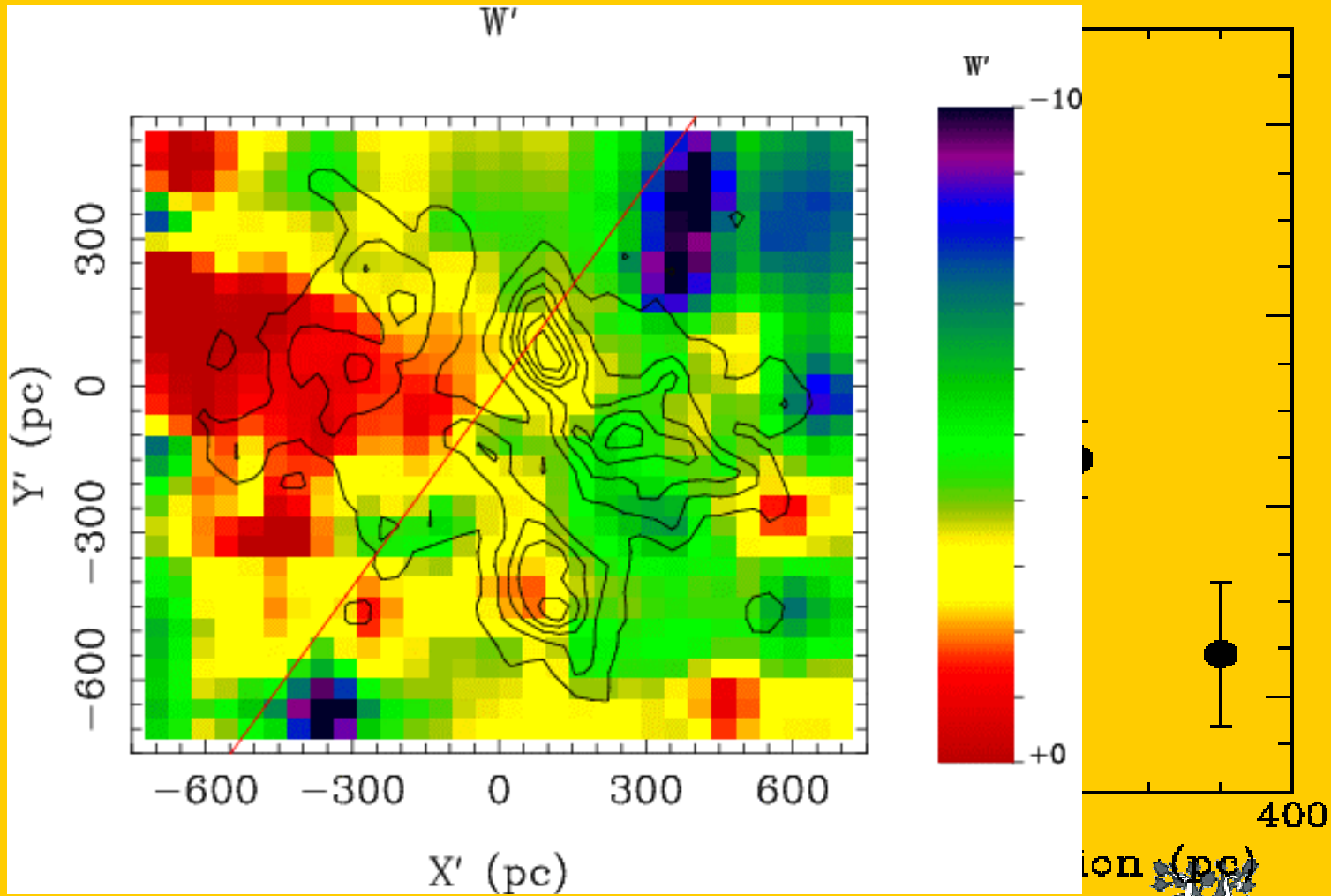




Campo de velocidad (I)

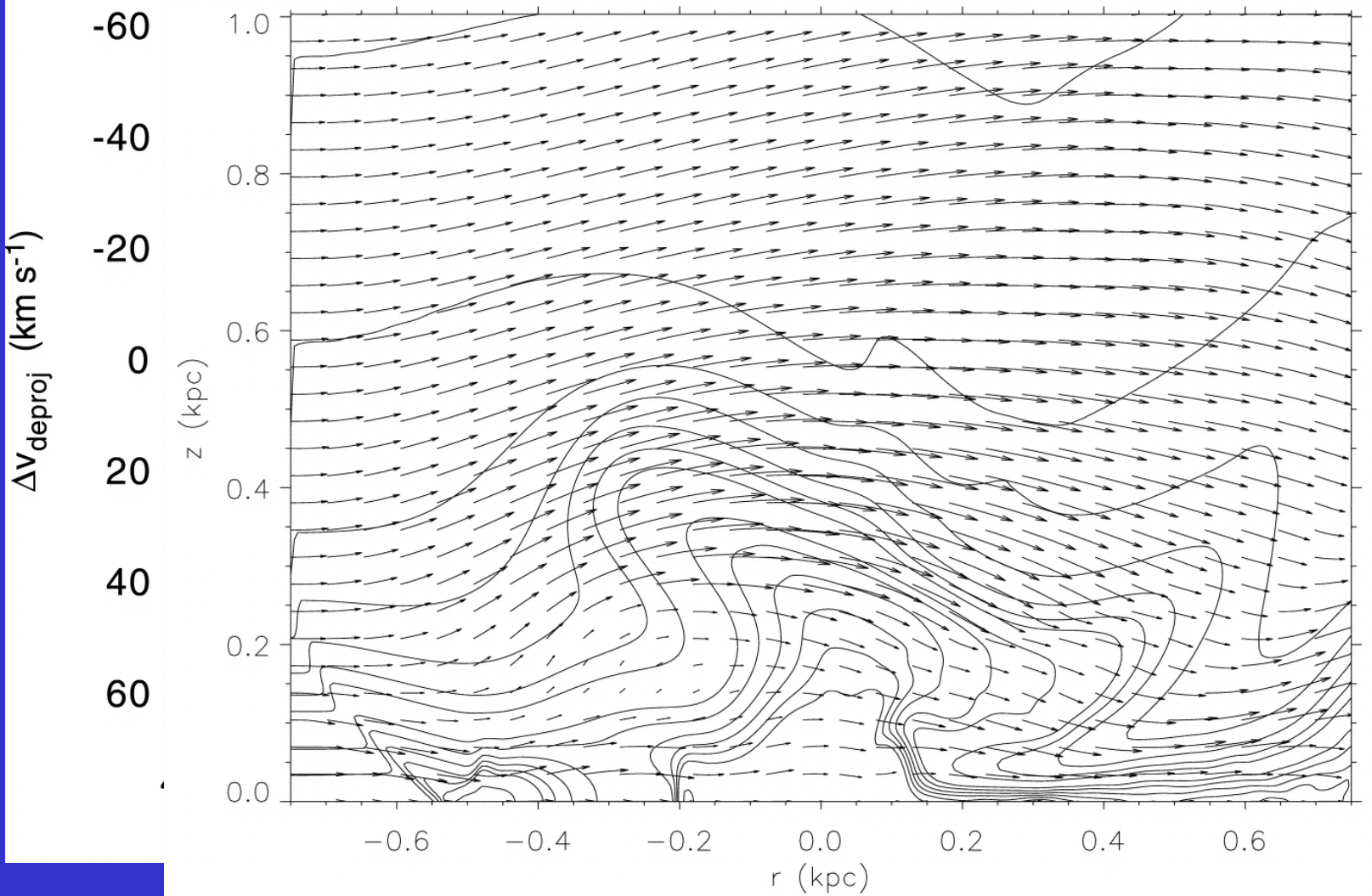
- ¿Corrugaciones del campo de velocidad?
  - Los modelos que explican la generación de corrugaciones espaciales predicen campos de la componente vertical de la velocidad que también están corrugados (Nelson 1976, 1985; Franco et al. 1989, 2000, 2002; Edelsohn & Elmegreen 1997; Kim et al. 1997, 2001; Santillán et al. 2000; Martos & Cox 1998; Gómez & Cox 2002; Fridman et al. 1998).
  - Sin embargo hay pocos trabajos que analicen o interpreten el campo de velocidad perpendicular al disco:
    - "Rolling motions"; variaciones de la velocidad radial con la latitud en brazos espirales de HI (Feitzinger & Spicker 1985; Yuan & Wallace 1973)
    - Campo de velocidad corrugado en el gas ionizado de M51 (Goad et al. 1979)
    - Corrugación radial de la velocidad en NGC 5427 (Alfaro et al. 2001)
    - A menor escala espacial, gradiente de W en el Gould Belt (Comerón 1999; Elías et al. 2001)

Gould Belt

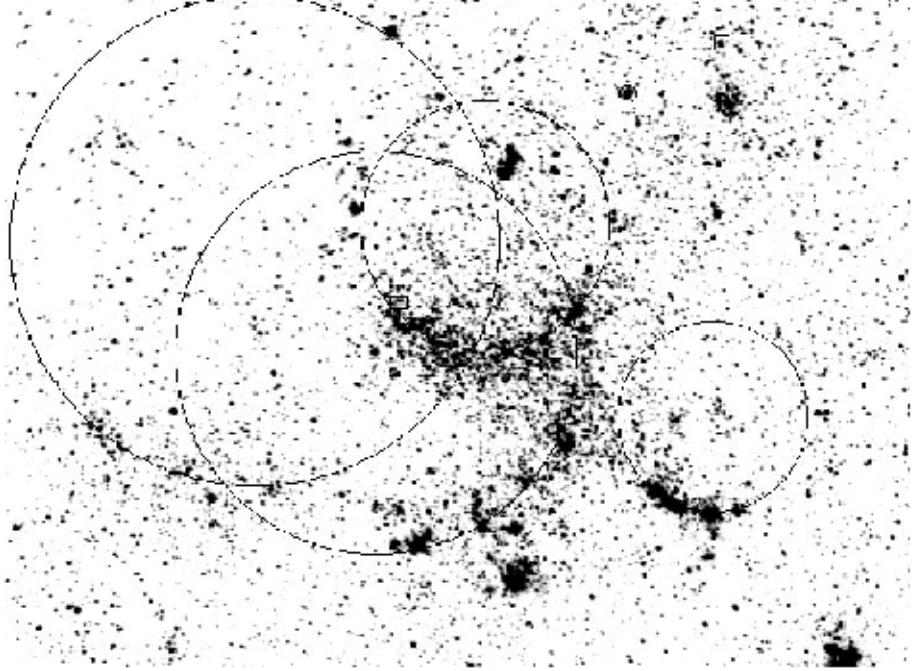


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Gomez & Cox (2002)



with the square of the density for those grid-zones with $n < 0.01$ cm^{-3}. It is similar in every feature to the vertical velocity at $z = 0.31$ kpc in Figure 6. The dotted line is the emission measure for the same positions. As the gas approaches the gaseous arm at 8.5 kpc, the flow rises to pass above it and then falls behind. Notice that the peak of the EM is upstream from the higher density gaseous arm in the midplane due to the forward lean of the arm at



Stellar arcs in the region of the supershell LMC 4 in the LMC (from right to left in order of increasing sizes and ages): Sextant, Quadrant, Third and Fourth Arcs. The reality of the Fourth arc needs confirmation. The cluster NGC 1978 is encircled; SGR 0526-66 (not far from NGC 1978) and A0538-66 (near the left edge of Quadrant) are enclosed in squares. North is at the top, and east is on the left.

case, the absence of GRBs in elliptical galaxies, whose massive (globular) clusters are all very old and in which there is no gas, is also quite comprehensible. There are no longer objects capable for superstrong explosions in classical old globular clusters. It may also well be that some supernovae observed far from galaxies could be associated with GRBs.

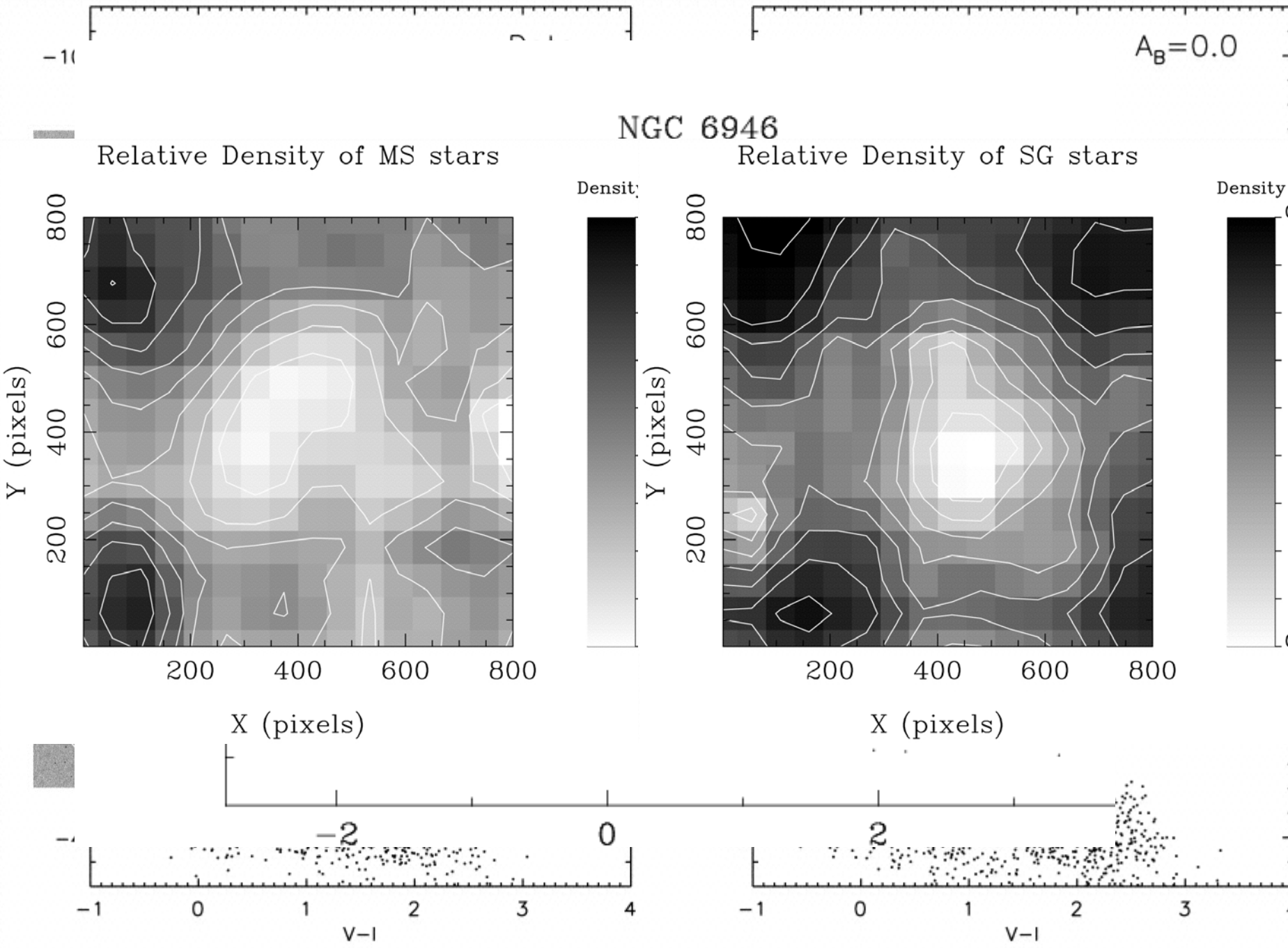
PECULIARITIES OF THE CLUSTER NGC 1978 AND ITS NEIGHBORHOOD

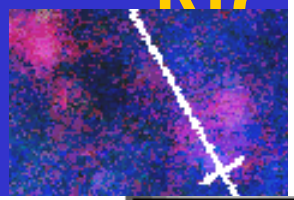
The existence of a system of stellar arcs, which form an isolated complex of arc-shaped stellar complexes with ages of the oldest objects ~30 Myr, suggests that the "mass escape" of GRB progenitors is observed only during a few tens of Myr, probably at the stage of a particularly high core density of the parent cluster. The unusual ellipticity of NGC 1978, as well as the abundance of blue stragglers in it, may also be associated with the high density of its core.

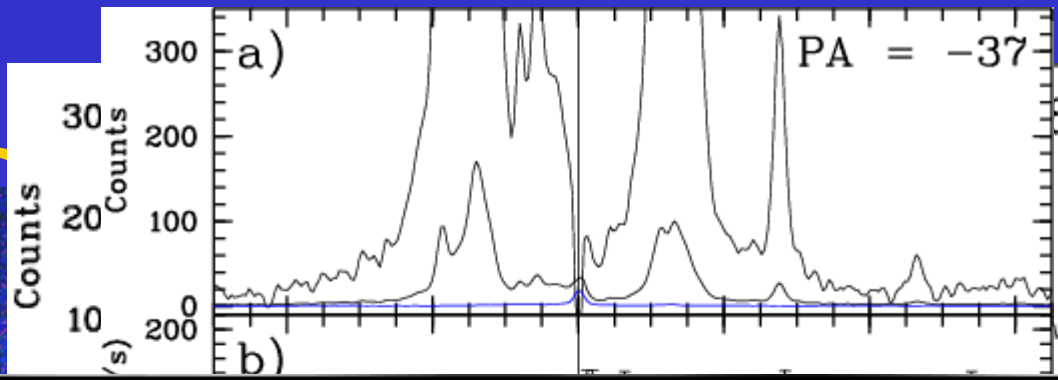
arcs lie in the galactic plane, while the cluster is most likely located near it.

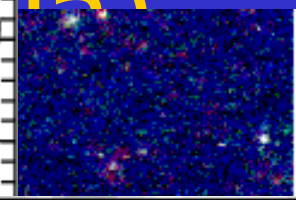
The uniqueness of the stellar arcs near NGC 1978 in the LMC most likely stems from the fact that this is a very rich and dense cluster, the most massive known cluster with an age of ~2 Gyr. The problem noted previously (Efremov 1999)—the absence of past GRBs with the center at the NGC 1978 itself—is also resolved: a merger in a pair of compact objects inside the cluster is highly unlikely, because, before this could occur, such a binary acquires a velocity after the components come closer together during encounters with a third star that is high enough to escape from the cluster.

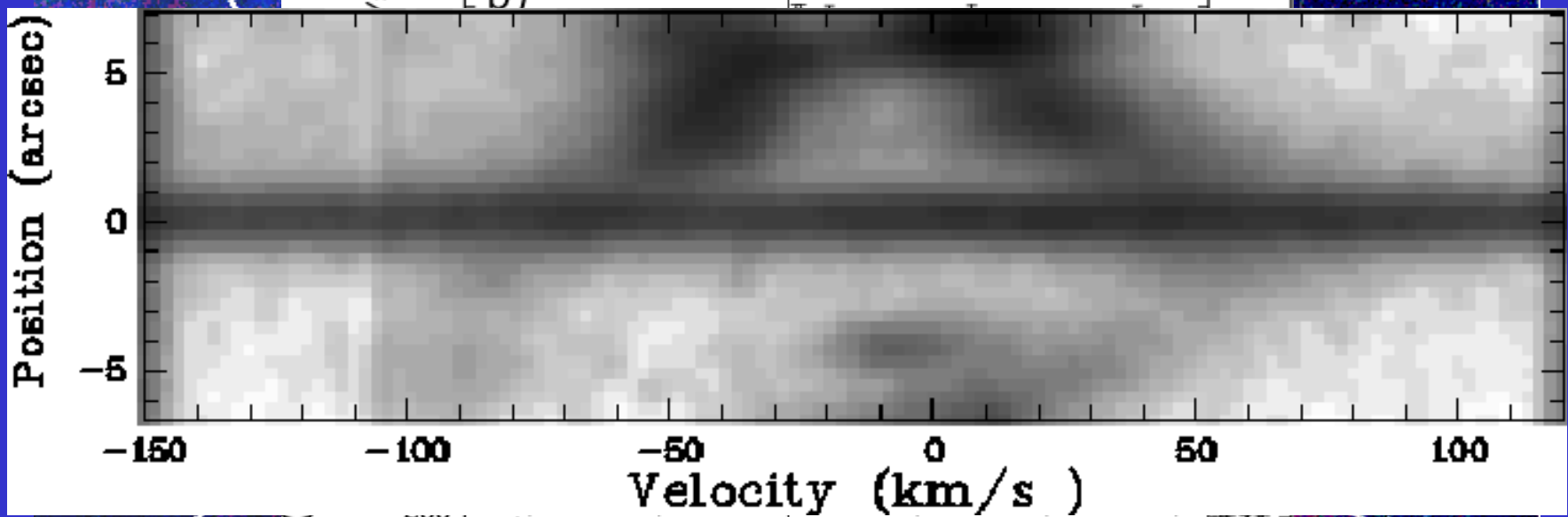
The figure shows that the major axis of this highly elongated cluster is approximately directed toward the LMC 4 center and the centers of the two stellar arcs; on the other side of the cluster, the soft gamma repeater SGR 0526-66 in the supernova remnant N 49 lies on the line connecting these centers and NGC 1978 (Efremov

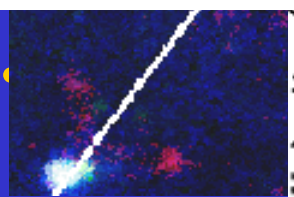

NGC 6946
Relative Density of MS stars
Relative Density of SG stars
Density
Y (pixels)
X (pixels)
200
400
600
800
A_B=0.0
−2
0
2
−1
0
1
2
3
4
V−I

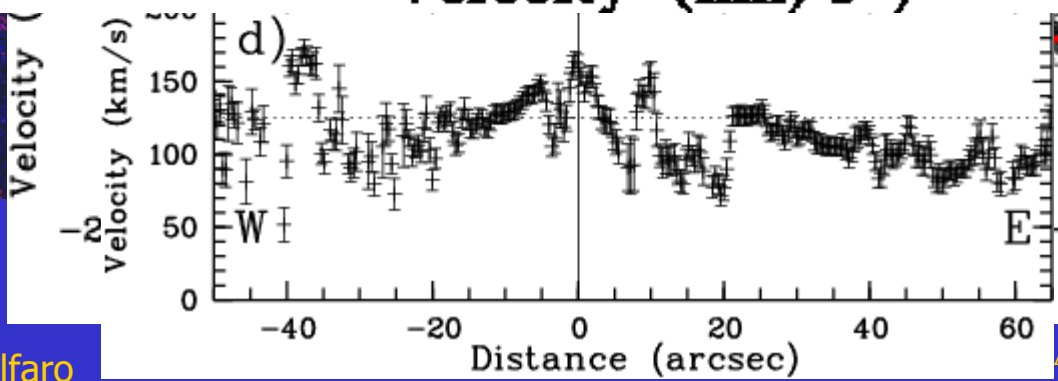


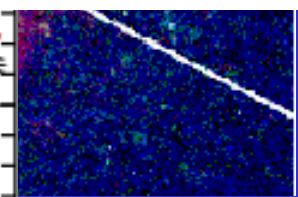












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Madrid, Enero 2003

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Futuro

- Campo de velocidades
  - Modelos teóricos (Franco, Kim y Cox; Fridman)
  - Datos (Observaciones y modelos; Campos bidimensionales) (E. Pérez)
  - GAIA en la Vía Láctea
- Complejos Peculiares
  - Catalogación
  - Historia de la formación estelar
    - HST, Grantecan (OSIRIS)
  - Cinemática del gas
    - OSIRIS

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- J. Franco
- M. Martos
- J. S. Kim
- Yu. N. Efremov
- B. Elmegreen
- S. Larsen
- P. Hodge
- T. Richtler
- S. A. Pustilnik
- A. Y. Kniazev
- A.G. Pramsky
- F. Elías