

# Interpretation of the gamma-ray signal from the Galactic center

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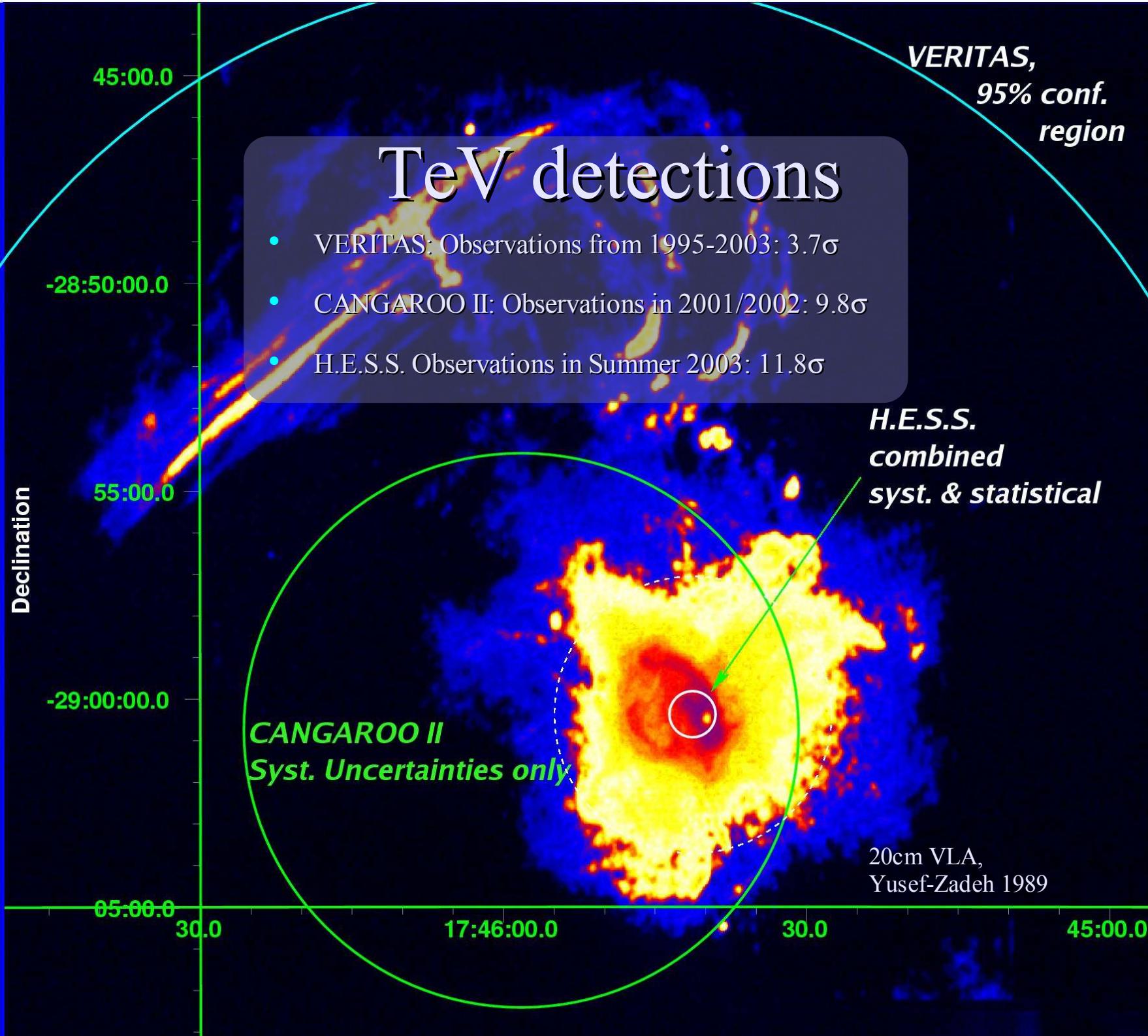
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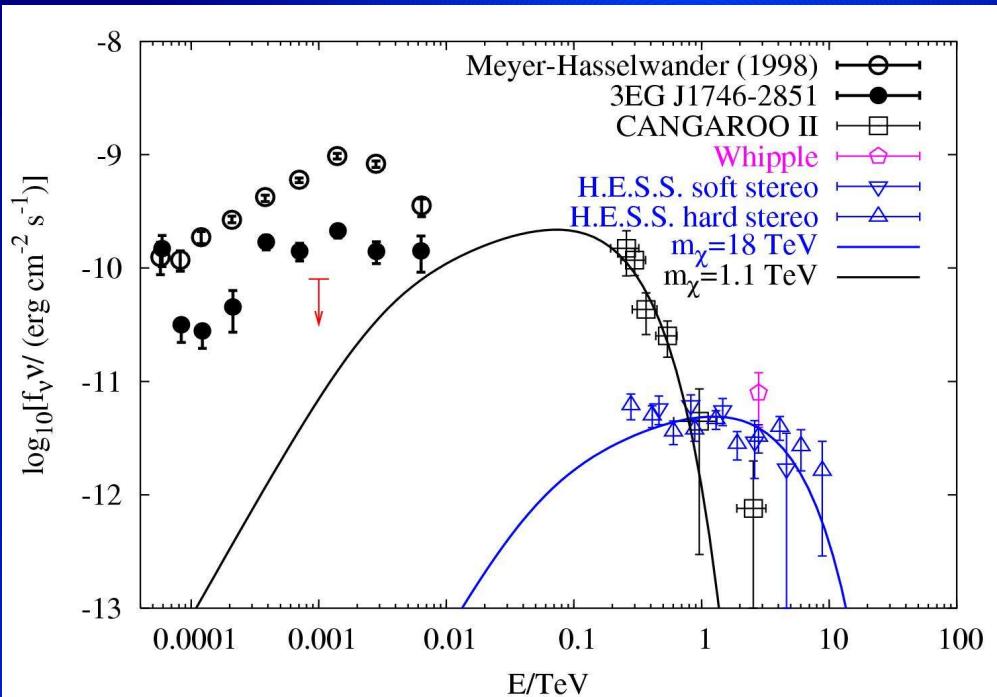
## Summary

- Galactic Center: A complicated region
- Strong TeV Gamma ray emission detected (3 instr.)
- Conventional Gamma-ray emission possible
- Annihilation Radiation not excluded:
  - Cuspy Halo ( $\rho \propto r^{-\alpha}$ ,  $\alpha > 1$ )
  - Massive:  $m_{WIMP} > 10$  TeV, not universal SuSy (unitarity limit:  $m_{WIMP} < 30$  TeV)
  - Average density  $r < 10$  pc:  $\langle \rho \rangle < 1200 M_{sol} \text{ pc}^{-3} \times \langle \sigma v \rangle_{-20}^{-1}$
  - or both...

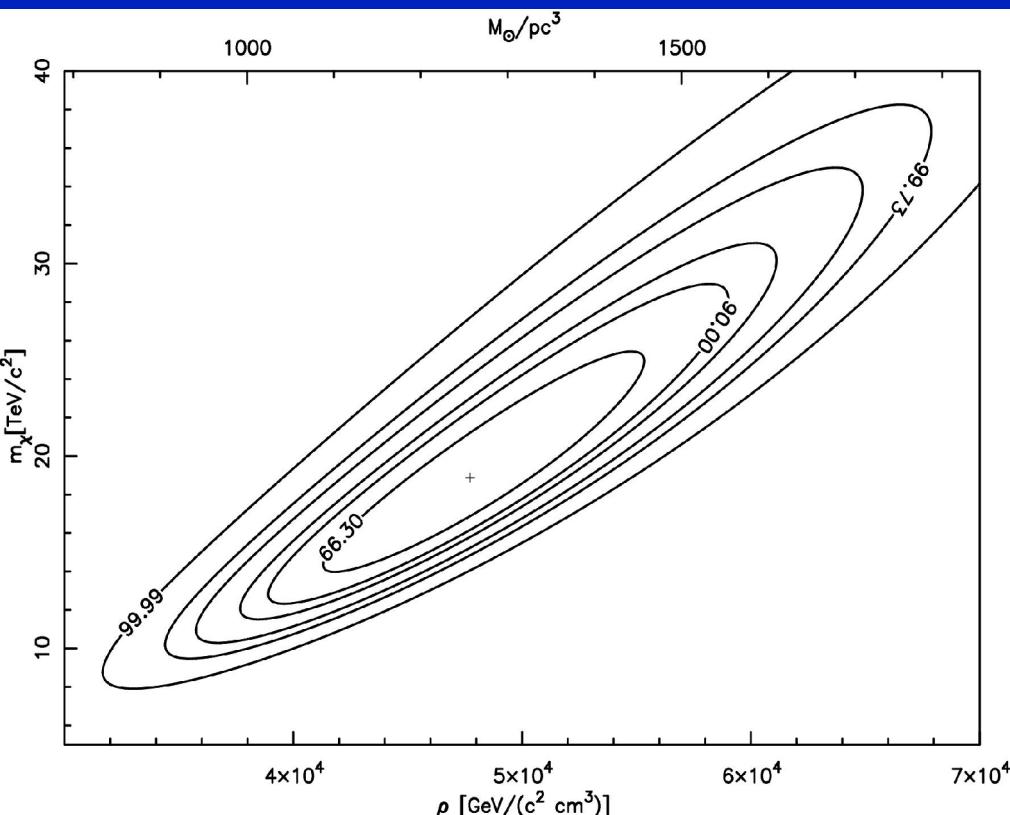
# Galactic center region

- Highly obscured in optical and soft X-rays
- Stellar dynamics: Central object with  $2 \cdot 10^6 M_{\odot}$
- Presence of Cosmic Rays, hot gas (diffuse X-rays, unknown heating process), ordered magnetic fields (arc)
- Sgr A\* in X-rays:
  - variable:  $t_{\text{flare}} \sim O(\text{hrs})$ ,  $\Delta F/F < 100$ , d.c.  $\sim 10\%$
  - quiescent level:  $\sim 0.3 \text{ cts/min}$ , H.E.S.S.  $> 0.5 \text{ cts/min}$



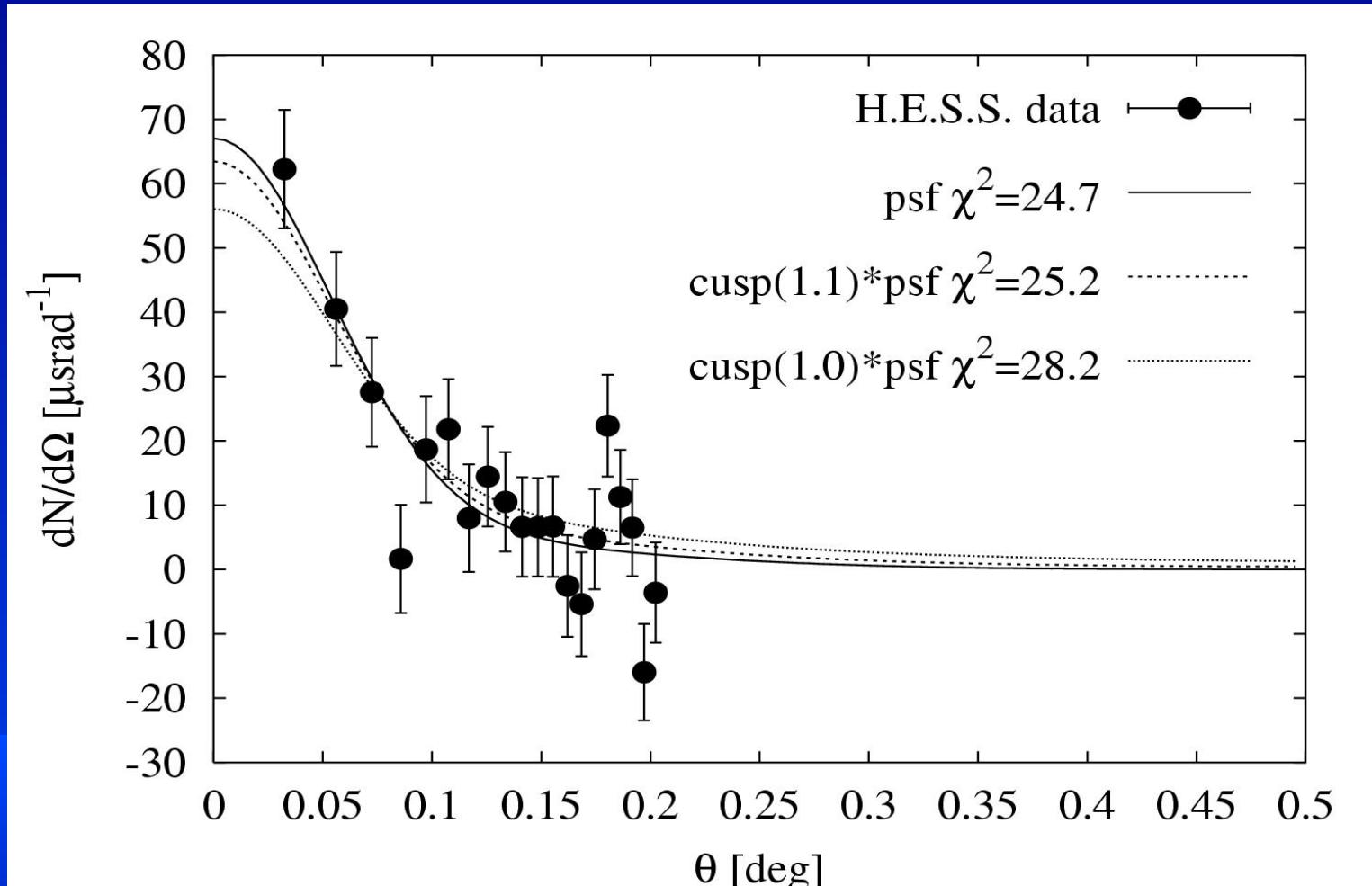


Fit of a Higgsino dominated annihilation spectrum to the data (Bergström et al. 1998), assuming  $\langle \sigma v \rangle = 3 \cdot 10^{-26} \text{ cm}^3 \text{ s}$



Confidence region favors massive (18 TeV) WIMP and dense distribution

# Cuspiness



H.E.S.S. data require a cuspy inner profile with  $\rho \propto r^{-\alpha}$  with  $\alpha > 1.0$  (90% c.l.)

# Could it be Annihilation radiation?

- Astrophysics:
  - Mini cusp with baryonic compression (Gnedin&Primack 2002, Merritt 2004, Prada et al. 2004)
  - BBN (Jedamzyk 2004)
  - Relic density: unusual large cross-section
  - other channels (Neutrinos, Antiprotons)
- Particle Physics
  - Hard limit (thermal decoupling)  $m_{\text{WIMP}} < 30 \text{ TeV}$  (Griest&Kamionkowski 1990)
  - SuSy Neutralino – too massive, but not impossible (needs fine-tuning: Feng et al. (2002), co-annihilation)
  - Far out of reach of accelerators

# (Still) consistent picture: TeV gamma-rays from WIMP annihilation in the Galactic center

- Massive WIMP ( $m_{\text{WIMP}} > 10 \text{ TeV}$ )
- Unusually large cross section (Wino/Higgsino, AMSuSy) to match relic density
- Cuspy central density (mini cusp from baryonic compression)

**WIMP annihilation not ruled out until variability is detected or spectrum extends to higher energies**